A Buyer's Guide To Simulations For The Commodore 64

COMPUTE!'s GAZETTE

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December 1986
Issue 42, Vol. 4, No. 12
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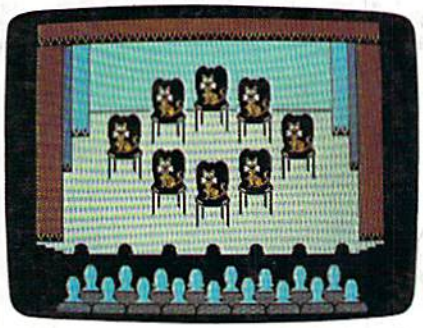

The Animals' Show

Write your own songs and then let the animals perform them. A delightful program for the Commodore 128.

Also In This Issue:

- Fast Hi-Res Screen Dump for Epson, Gemini, and compatible printers
- User Group Update
- Sprite Locater
- Software Reviews
- And More

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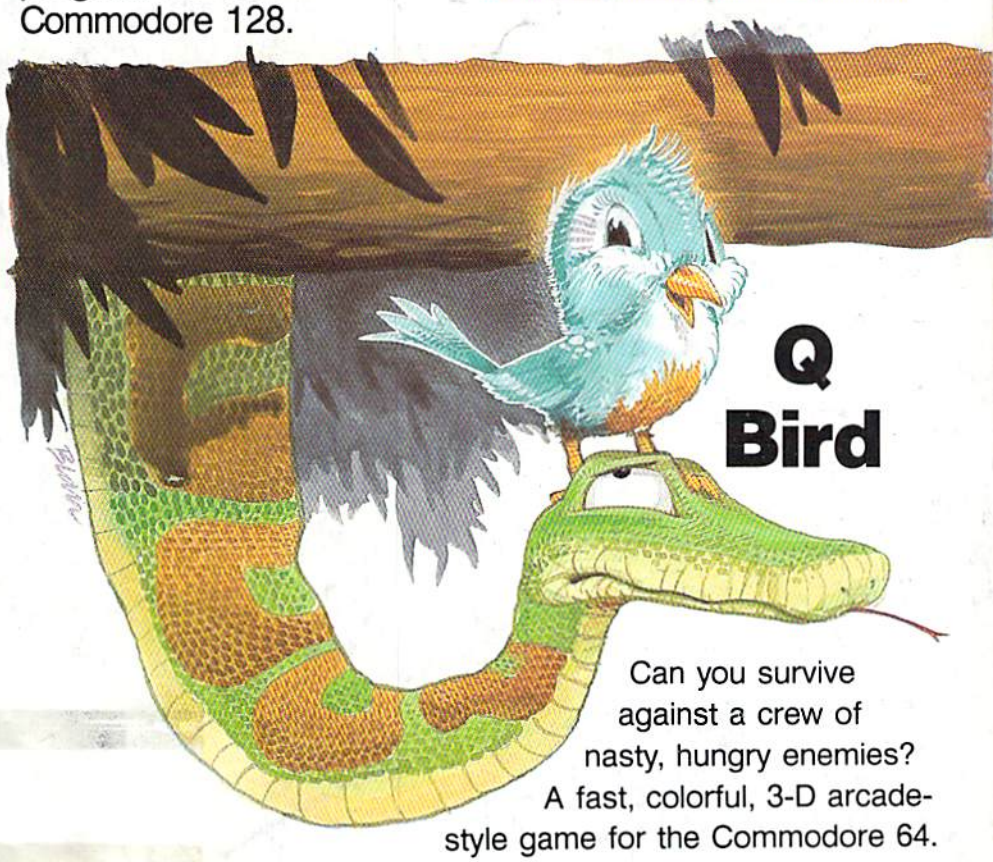
Compare BASIC programs or source code files with this short, handy utility that sends the results to your screen or printer. For the 128, 64, Plus/4, and 16.



Q Bird

Can you survive against a crew of nasty, hungry enemies? A fast, colorful, 3-D arcade-style game for the Commodore 64.

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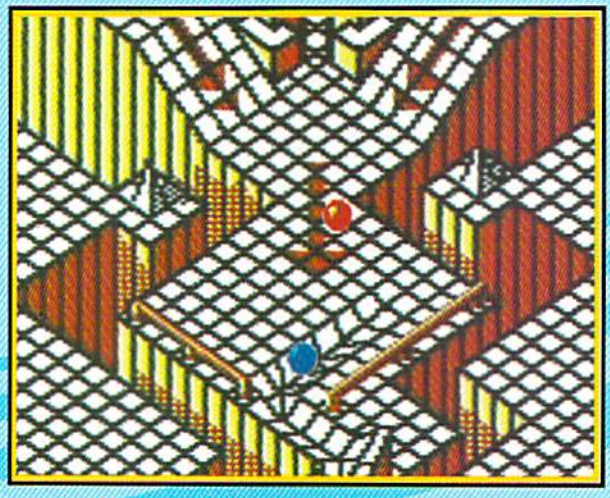
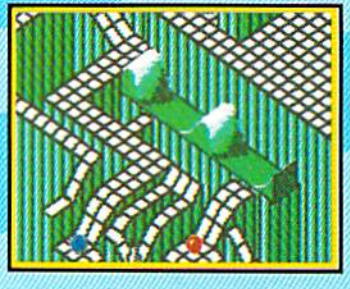


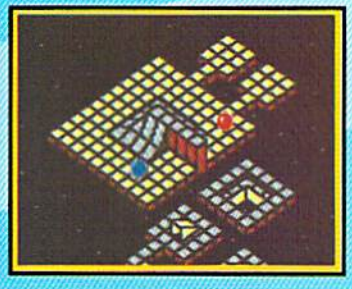
A unique game experience that's crazy fun for everyone. Two players race to the goal line, or one player races against the clock. It's sports competition, kinetics and strategy.

Ultimate Competition for 1 or 2 players.
The object is simple. Race your marble to the goal line, and don't let anything get in your way. It sounds easy, but it just might drive you nuts.



Spectacular Animation
Fantastic 3-D terrains are the raceways. Zany (but dangerous) enemies await your every turn. Avoid the deadly steelies and the pounding hammers. Watch out for the hungry marble munchers. Even surf a mechanical wave!

Secret Level
If you can find it, just wait till you try to get through it!



Incredible Madness
Marble Madness, the ultimate in exciting non-stop action. Each level has its own "personality" and creatures to contend with, as well as its own original music score. It's not easy being a marble – make it to the Ultimate Level and you'll know why.

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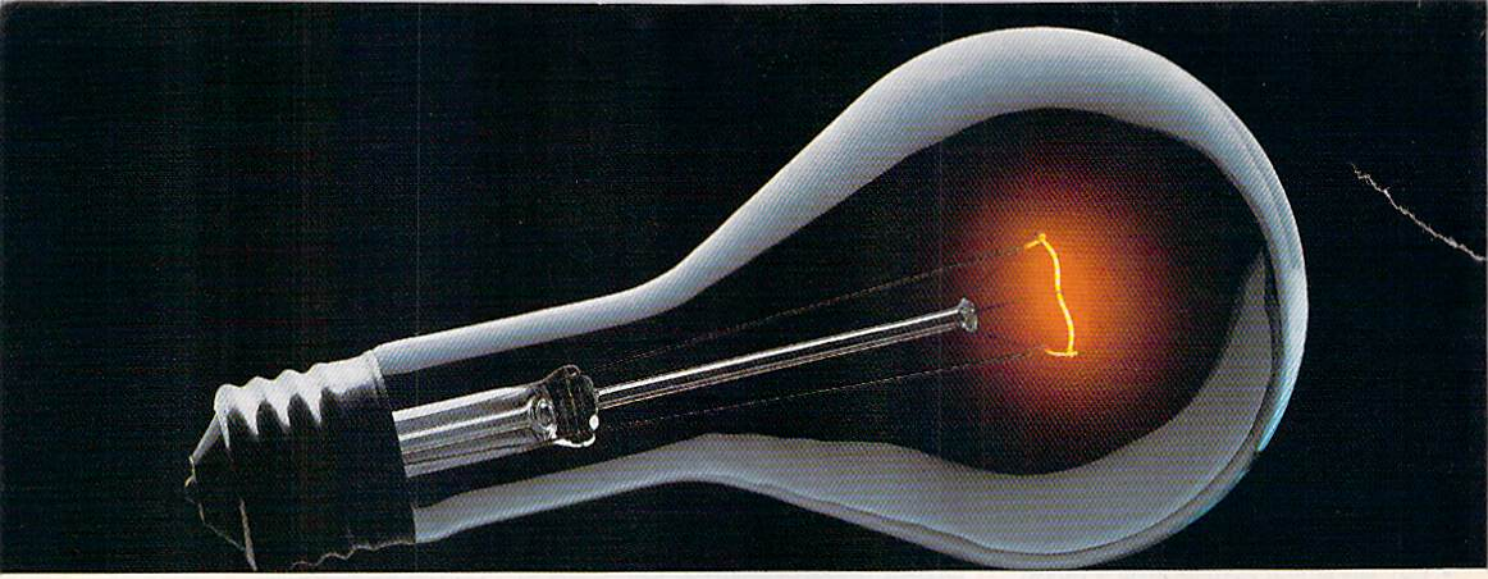

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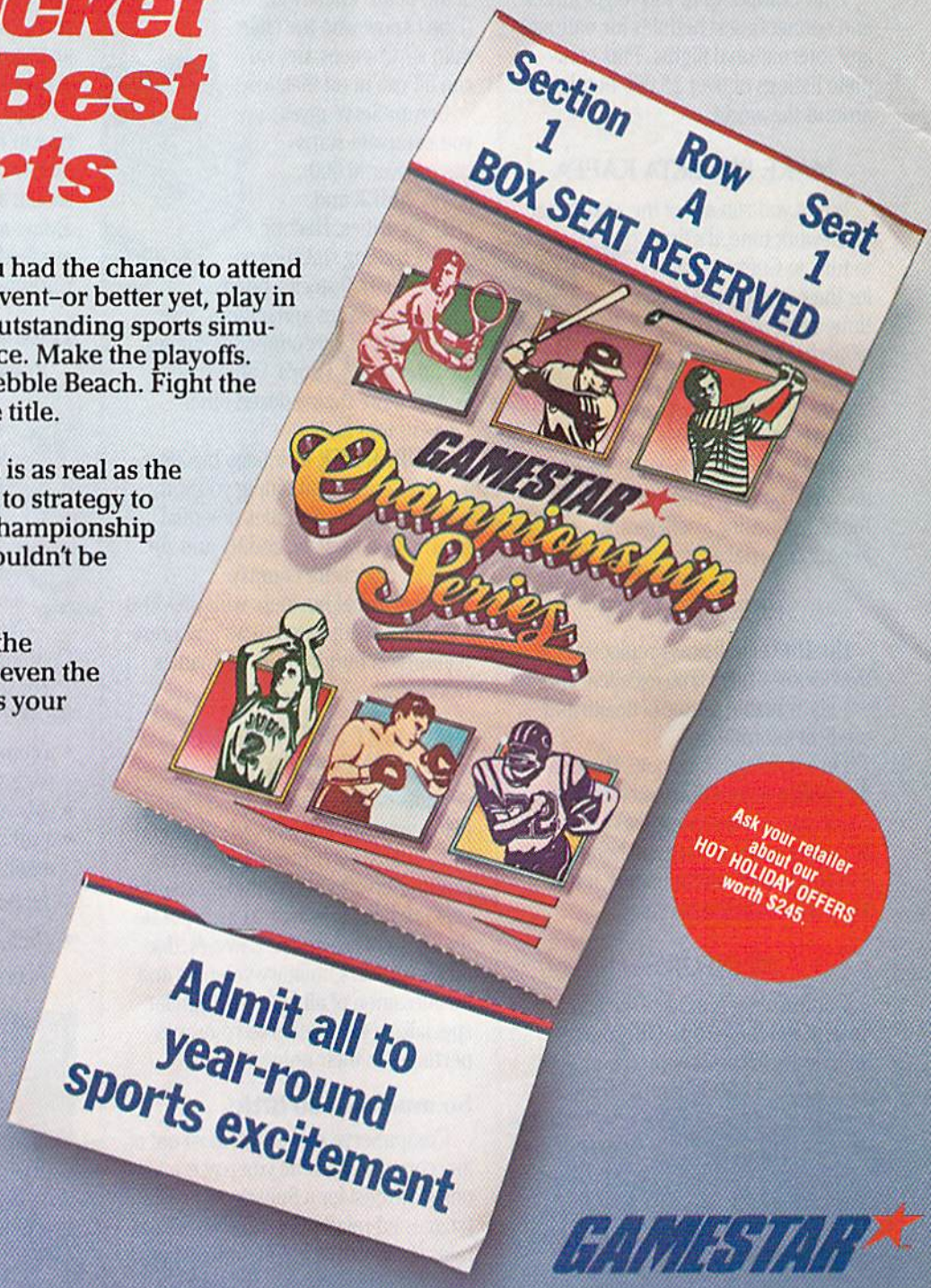

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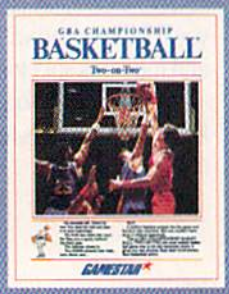

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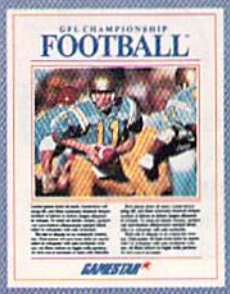

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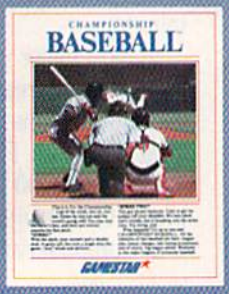

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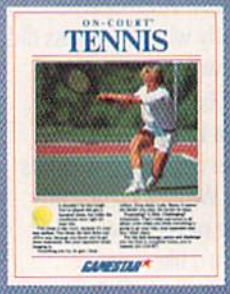

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*=General, **V**=VIC-20, **64**=Commodore 64, **+4**=Plus/4, **16**=Commodore 16, **128**=Commodore 128

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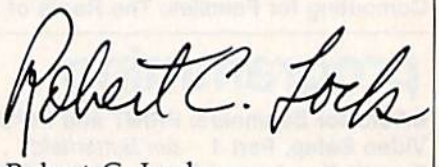
editor's notes

The numbers war crunches on. A recent editorial here was sharply critical of the historically unaggressive approach Commodore has been taking to the marketing of the Amiga. We continue to hope that Commodore will adopt a less passive stance and accelerate the sales of an otherwise very impressive machine. But, since we wrote that editorial, we've discovered a very interesting number. The *Software Industry Bulletin* (Vol. II, No. 38) reports that the preliminary prospectus filed by Atari recently (in its quest to go public) indicates that, as of June 30, 150,000 Atari systems had been sold. This conflicts with the numbers we had used as a basis for our previous editorial, and since these have been filed with the Securities and Exchange Commission, we must assume they are more reliable. Perhaps earlier estimates we had received included machines still in the pipeline or perhaps Atari was simply hopeful. In any event, the Atari ST at that time was outselling the Amiga, although not by the magnitude we then suspected. But, as we pointed out in an earlier editorial, Atari's sales included the European market, where Commodore had not yet begun selling the Amiga. Maybe *we'll* have to resort to passive vagueness for future numeric comparisons. Is it now quite perfectly clear?

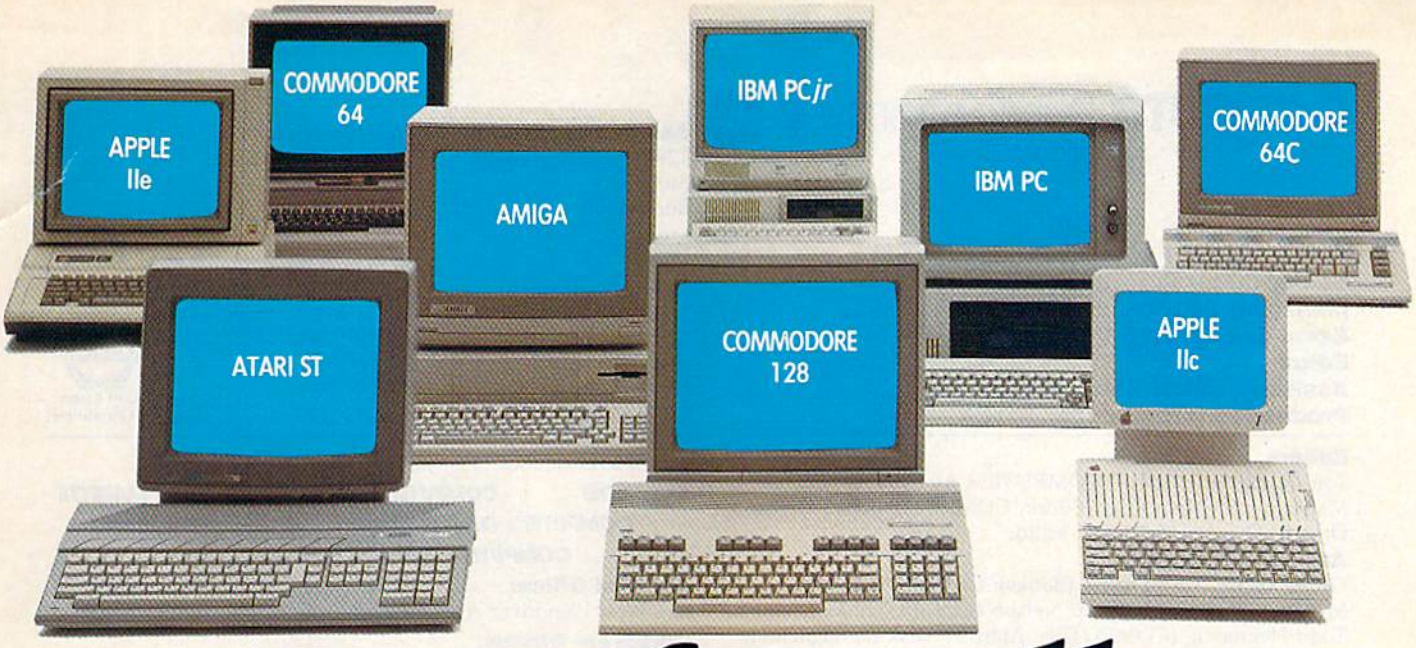
At the recent Software Publishers Association meeting outside of Washington, D.C., industry insiders gave mixed reviews to the 64C. While many were favorably inclined toward *GEOS*, some were outspoken in questioning the need for it. Maybe we should describe it as an emperor's new clothes phenomenon, although in this case the new clothes are real and some are questioning the need for them. In any event, the 64 keeps selling and that is positive news for software vendors and for Commodore.

By the time you read this, we'll be just a couple of months away from the January Consumer Electronics Show, and just a few weeks away from COMDEX, the computer dealers' show. We're anxious to see what repositioning and other new clothes Commodore might have in store for the new year. We continue to feel it's a great bag of products; it's just that the delivering reindeer have grown a bit balky. Our wish list would include a continuance of the product foresight that has brought us all into one of the longest periods of product life we've seen in this industry *ever*. Maybe we'll leave more aggressive marketing of the Amiga on our list. Who knows *what* might happen. We'd like to see some exciting new recreational software (we're fudging on this one; we've previewed some of the new products advertised in this issue). And some exciting new software that's not recreational (again, we've peeked).

We continue to provide you with the very best in applications and coverage useful to you as a computer user. We're also pleased by your continued support and encouragement. Thank you. And until next time, enjoy your issue.



Robert C. Lock
Editor in Chief



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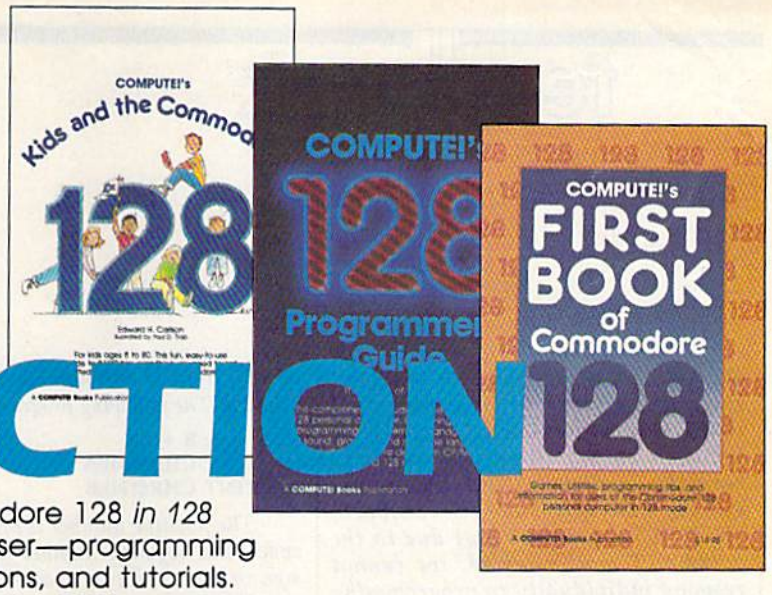

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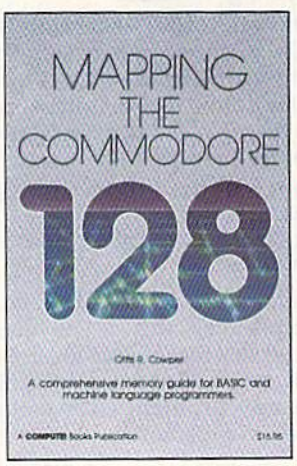

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Do you have a question or a problem? Have you discovered something that could help other Commodore users? We want to hear from you. Write to Gazette Feedback, COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403. We regret that due to the volume of mail received, we cannot respond individually to programming questions.

Separating Variables

I have seen PRINT statements that do not use semicolons between different sections (strings and variables mixed on one line). Does the semicolon cause an extra space? When is it necessary? Will these two lines print the same?

```
10 PRINT"HIGH SCORE="HS" YOUR
   RANK IS "R$
10 PRINT"HIGH SCORE=";HS;" YOUR
   RANK IS ";R$
```

Another question: Why do I see programs omit the closing quotation mark? Is this the same as reverse mode, which is canceled by a RETURN? Is there any problem with using this method in programs?

Denis H. Gregg

Semicolons first. The two examples do the same thing, as you'll see if you type them in. Semicolons are optional when you're alternating string literals and variables, at least in Commodore BASIC. Some other BASICs require the semicolons.

Semicolons are required when two variables are printed one after another. Run the following program to see how this works:

```
10 AB = 5: CD = 6
20 PRINT AB;CD
30 PRINT ABCD
```

In line 20, the variables are separated by a semicolon and values for both are printed. In line 30, the computer sees ABCD as a four-letter variable. Only the first two letters of a variable name are significant, so only the value for AB will be printed in this case.

The semicolons have nothing to do with the extra spaces you may have noticed with numeric variables. A positive number is printed with a leading space and is followed by a cursor right. The extra space is there to make room for a minus sign in front of the number, in case it's negative. The following program illustrates:

```
10 A = 5: B = -5
20 PRINT CHR$(34);A
30 PRINT CHR$(34);B
```

The positive number is preceded by a space, the negative number has a minus sign in front (with no space). By printing the CHR$(34), we put the computer into quote mode. The reversed bracket you see following each value is the quote mode equivalent of cursor right.

As you've noticed, reverse mode is canceled by a RETURN, as are quote mode and insert mode. The computer is in quote mode whenever an odd number of quotation marks have been typed. Insert mode is activated by pressing the shifted INST/DEL key one or more times. It's identical to quote mode, except that the unshifted INST/DEL key prints as a reverse T in insert mode. It deletes characters in quote mode.

Since RETURN cancels quote mode, the closing quotation mark is optional when you're printing a string. There's an exception, though. If the string ends with spaces, the spaces won't be printed to the screen. To make sure the trailing spaces appear, either end the string with a quotation mark or use shifted spaces (hold down the SHIFT key and press the space bar).

The only advantage to these two techniques is that by leaving out semicolons and closing quotation marks, you save a byte of memory here and there. Unless you're strapped for memory (the unexpanded VIC comes to mind), there's no advantage to using either technique.

Reliable Tape Loading

I own a Commodore Datassette. I often get load errors for no reason. When I list the program, it starts out okay, but then I get some strange-looking lines. Sometimes they have line numbers, but when I try to delete them, my computer locks up. Please help me with this problem.

Lyle Glass

Although cassette storage is generally very reliable, it isn't perfect. Here are some guidelines that can help you work around the errors.

• Try to load the program again. If this doesn't work, fast-forward to the end of the tape and rewind back to the beginning before you try again. This procedure helps tighten up the tape.

• Use ferric-oxide rather than chromium tapes. Chromium tapes are advertised as having better quality for sound recordings, but they require a stronger magnetic signal. Ferric-oxide tapes are better for recording computer programs. They also cost less.

• If you've had your Datassette for a while, the tape head may be dirty or magnetized. Using a head cleaner and demagnetizer—available at most record stores—may solve your loading problems.

• Try to use short tapes when you save programs. Tape players can have difficulty maintaining a constant speed with long tapes.

• It sometimes helps to move your Datassette away from your television and your computer's power supply, since they emit magnetism which can corrupt the data sent from the Datassette to your computer.

• To make sure you never lose a program, always save your important programs on two different cassettes.

If none of the above suggestions works, the tape may be damaged, or you may have accidentally saved another file over the end of the program. Try this after you get a load error. Type it in direct mode (without a line number), and do not press RETURN until you've typed all of it:

```
FOR X=45 TO 49 STEP 2:POKE X,PEEK
  (831):POKE X+1,PEEK(832):NEXT
```

This may restore your program.

Ones AND Zeros

I have typed many programs on my Commodore 64 with lines like the following:

```
10 POKE 53265,PEEK(53265) AND 248
```

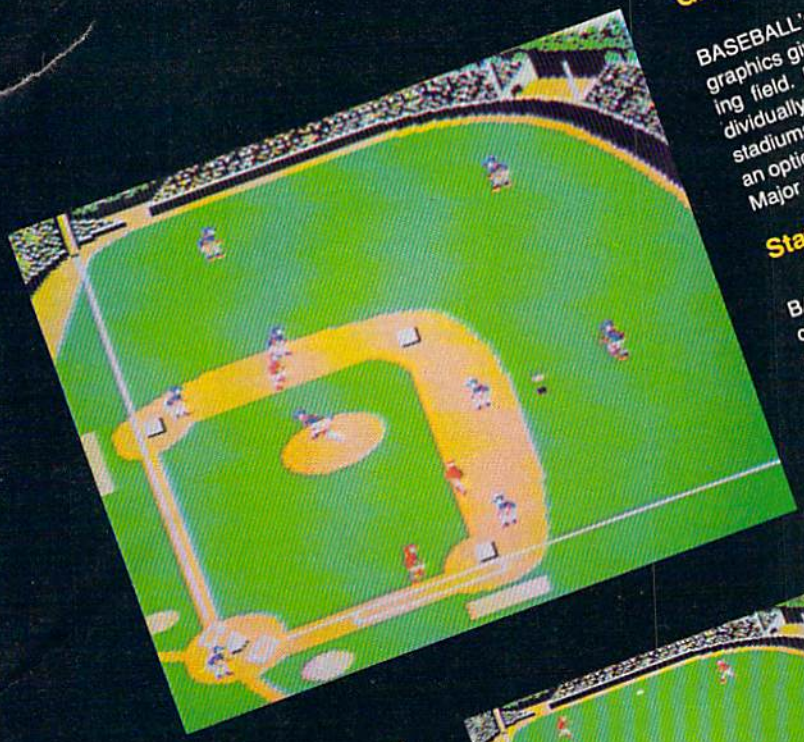
Could you please explain what the part after the comma does?

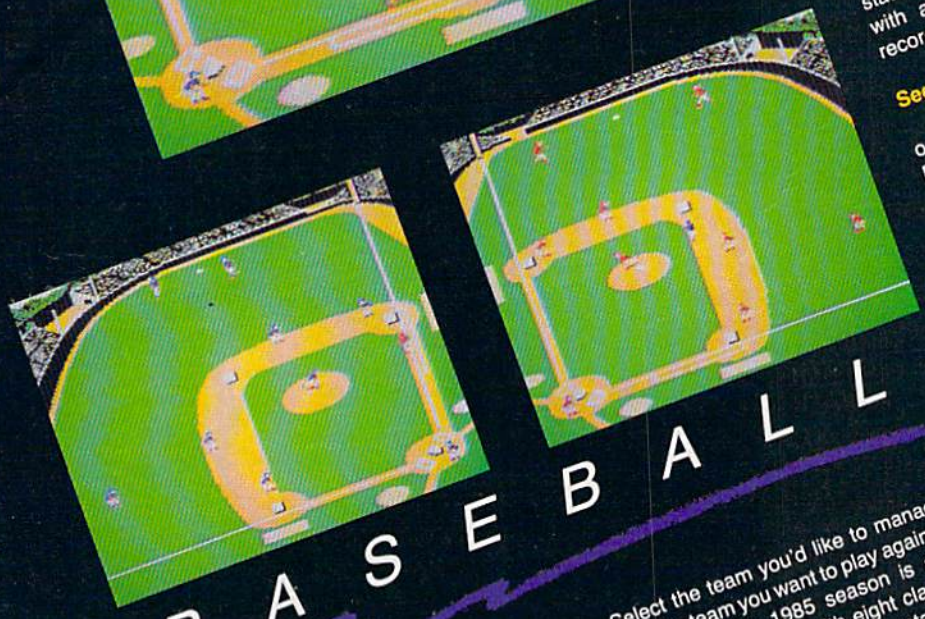
H. K. Miner

Many programs use AND in its most common use—as a boolean (logical) operator. You've seen it like this:

```
IF A>=10 AND A<=20 THEN PRINT
  "IN RANGE!"
```

This statement prints out a message only if the variable A is within the range 10–20. Two conditions are tested: Is A





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greater than or equal to 10? Is A also less than or equal to 20? There are four possibilities:

TRUE AND TRUE = TRUE
TRUE AND FALSE = FALSE
FALSE AND TRUE = FALSE
FALSE AND FALSE = FALSE

As you can see, the only time the whole thing is true is when both parts are true. If the statement were ***IF A>=10 OR A<=20****, then only one or the other (or both) would have to be true for the THEN to happen (as a matter of fact, this statement is always true; all numbers are either greater than 10 or less than 20). When you OR two statements, the result is true unless* both *statements are false.*

Now substitute ones and zeros:

1 AND 1 = 1
1 AND 0 = 0
0 AND 1 = 0
0 AND 0 = 0

The ones act like the true statements, and the zeros act like false statements. This is called a bit-wise AND.

If you were to PRINT PEEK(53265), you might see the number 27 appear on the screen, so location 53265 holds the value 27. These numbers are expressed in decimal notation (base 10), a numbering system that arose because people have ten fingers. Within a computer, however, it's easier to store numbers as binary (base 2) numbers. The only two binary numbers are 1 and 0, which might also be called on and off or true and false.

The value 248 looks like this in binary: 11111000. Using a bit-wise AND makes the resulting bit 1 only if the corresponding bits of both *values being compared are 1. So in the example you gave, the value 248 masks out the three lower bits from location 53265. These bits will be 0 in the answer, while all the other bits will take on the appropriate bit values from location 53265. Let's say location 53265 had the value 27 (binary 00011011).*

```
  00011011
AND 11111000
------------
  00011000
```

Why turn off individual bits? Within the memory of the 64 are a series of hardware registers which control the actions of the video chip, the interface chips, and various other chips. Some registers control a single function; location 53281 is a VIC chip register which determines the color of the screen, for example. But other registers, such as 53265, have several purposes. Sometimes you need to change just one or two bits in a certain location, but leave everything else the way it is. That's where bit-wise ANDing comes in.

In location 53265, the lower three bits control vertical fine scrolling. ANDing with 248 resets these bits to 000, canceling any previous scrolling without disturbing the setting of any other bits in the register.

If we wanted to turn on a bit, we'd use an operator similar to AND—the OR operator. With OR, the result is 1 if either (or both) of the tested bits are 1's. Let's say we had already performed the operation above and had the value 24 (binary 00011000) stored at 53265. Bit 5 (the sixth bit from the right) in that register controls whether or not the VIC chip is in bit-mapped mode. We could use an OR to turn that bit on.

```
  00011000
OR 00100000
------------
  00111000
```

The BASIC equivalent would be:

```
20 POKE 53265,PEEK(53265) OR 32
```

Problems With COLLISION

I have been trying to write a game program on my new 128, but I'm having trouble with the COLLISION command. It detects the first collision between two sprites; all subsequent collisions are ignored. I have enclosed a listing of my program.

James R. Rudolph

COLLISION is a rather unusual command. It's best described as a delayed GOSUB command. It puts the 128 in a state where, if a collision occurs, the computer finishes whatever command it is executing and then executes a GOSUB to the subroutine that handles collisions. In your program, the ***COLLISION1,3100*** *statement tells the computer to GOSUB 3100 whenever two sprites bump into each other.*

Because it's a GOSUB that starts the routine, the section that handles collisions should end with a RETURN. By the way, it's not necessary to turn off the COLLISION routine while the subroutine is working. Just be sure to end it with a RETURN (not a GOTO).

Copy-Protection Blues

I have a 1571 disk drive for my 64. I recently wanted to purchase a commercial program, which was marked "for the 1541 only" on the box. The store owner tried the game on a 128 with 1571 drive. The title screen came on, but after that the screen turned fuzzy. The program did not work. Is the 1571 not totally compatible with all 64 software?

Chad Cummings

I have an Enhancer 2000 disk drive and a friend has a 1541. All of my copy-protected games load and run on his drive with little or no problem, but many of them won't even load on my 2000. Do I have to buy a 1541 to run these special disks? What's the problem here?

Martin Ray

I have an MSD dual disk drive I use with the 64. Several software companies write software that apparently will run only on a 1541 disk drive. When I load such programs, I get the title screen and then the drive sets off for never-never land.

The MSD is a hardy drive and I don't relish the thought of buying a 1541 unless it's necessary. Thanks for your help.

Robert L. Garoutte

There are some programs that work only when a 1541 is connected to a Commodore 64. They will not load from other disk drives. This can be attributed to the copy-protection scheme that many software companies add to their disks. The main purpose of copy protection is to prevent users from making copies of commercial software. Copyright laws make it illegal to copy and distribute books, songs, computer programs, and other creative works without permission from the author.

To prevent illegal copying, software companies often modify programs to make them difficult to copy. There are a variety of ways to protect software—adding disk sectors, introducing errors (which the software checks for) on the disk, using undocumented machine language op-codes, reprogramming the disk drive, and so on.

Very often, a program that employs copy protection will not load and run on any disk drive other than the 1541 or a perfect duplicate of the 1541. A disk-drive manufacturer could make an exact copy of the 1541 (including the ROM code inside), but that, in itself, would be illegal because the DOS that runs the 1541 is a program covered by copyright. So disk-drive manufacturers create work-alikes, *drives that do the same thing as a 1541 without using the same program to control the drive. If a copy-protected program depends on a certain routine located at a certain memory address inside the 1541, it probably won't work on a non-1541 drive. And there's not much you can do to change the program.*

Vicious Protection

I recently had a puzzling problem with my Commodore 128. I was using a database program in 64 mode. The program disk and data disk had each been used a number of times.

I'm not sure which key I pressed, but suddenly the screen went white and displayed large letters reading CRASH. There's no reference to CRASH in my user's manual. What does it mean?

Subsequent efforts to load data from the data disk resulted in a response of no data found. Loading the directory displays a disk named "PIRATE" 01 2A with 664 blocks free. What the heck is the significance of this message?

I am using a Commodore 1571 disk drive, and all other programs seem to behave normally. A considerable amount of data was on this disk, and I

WAR GAMES

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FALKLANDS 82

Falklands 82 is a simulation of the conflict between the Land Forces of the United Kingdom and Argentina over the period 21st May to 15th June 1982, following the invasion of the Falkland Islands by the forces of the Argentinian Junta. The screen map represents the Northern part of the East Falkland Island where the major part of the land combat took place.

The player commands the United Kingdom forces whilst the computer commands those of the Argentine, and the simulation takes place over 25-30 days depending on which level of difficulty is selected

BATTLE OF BRITAIN

The Battle of Britain took place between July and October of 1940, and was the German Luftwaffes attempt to defeat the R.A.F. and gain air superiority prior to Operation Sealion – the invasion of Great Britain scheduled for the summer of that year. The ensuing battle has gone down in history as one of the most courageous of WWII culminating in the defeat of the Luftwaffe and the cancellation of Operation Sealion.

In the famous words of Winston Churchill:
"Never has so much been owed by so many to so few"

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would hate to retype it all. Can you suggest any means of rescuing the data?

William T. Quick

It sounds as if you're the victim of a vicious sort of copy-protection. The program probably did a check to see if you were using the original disk or a copy, by looking for a disk error in a certain place or reading a specific track or sector for a hidden message. For some reason, the program didn't find what it was looking for (whether or not you actually had the original) and erased your data disk.

The significance of pirate *is that's what people who make and distribute illegal copies of programs are sometimes called. You probably won't be able to recover the data and you'll have to type it in again, using another database (you probably wouldn't want to try again with that particular program).*

End-Of-Program Pointer

In the September "Gazette Feedback," you explained that loading a longer program from a shorter one could cause problems. Well, I've come across that problem and was interested when you said that it could be solved by POKEing to memory locations 45 and 46 at the beginning of the first (shorter) program. However, you forgot to tell what numbers to POKE there. Could you please give me the numbers to put there?

Glen Pittman

There's no single answer to your question; it depends on the lengths of the two programs. Load the short program and type this:

```
PRINT PEEK(45), PEEK(46), PEEK(45)
  +PEEK(46)*256
```

You'll see three numbers, the values in 45 and 46, plus the memory location that these numbers point to, which happens to be the end of the BASIC program and the beginning of variables. Now load the second (larger) program and type the same line. The third number should be larger than before.

At the beginning of the first (short) program, add a line that reads **POKE 45,x: POKE46,y: CLR** *where* x *and* y *are the numbers from the larger program. There's a small chance that the two programs are very close to the same size and that adding the two POKEs will make the first program larger than the second. Just to be safe, type the PRINT PEEK line one more time. If the third number is still smaller than the third number from the larger program, then you're in good shape. If the first program is now longer, replace the line containing the POKEs with a REM and 30–40 characters (it doesn't matter what they are; maybe you could add the name of the program and your name).*

Adding New Program Lines

I have a program that needs a line changed each time it is run. I tried using INPUT, but I can't change the string into a program line. Then I tried the following line:

```
10 PRINT "190 DEF FX(I) = ABS(EXP
   (I^2))"
```

I need a way to move the cursor to that line and execute a RETURN, to put line 190 into memory. Needless to say, I was unsuccessful. Can this be done?

Michael A. Lunsford

The dynamic keyboard technique *is what you need. On the 64, memory location 198 keeps track of how many keys have been pressed (up to ten characters), and locations 631–640 hold the ASCII values. To put the line into memory, add the following instructions to your program.*

First, clear the screen and have your program print **190 DEF FX(I) = ABS (EXP(I^2))** *on the top line, in preparation for pressing RETURN over it. Next,* **POKE 631,19: POKE 632,13: POKE 198,2.** *This instructs the computer that {HOME} and RETURN—CHR$(19) and CHR$(13)—have been pressed. The POKE to 198 indicates that two keys have been pressed. Finally, END the program. Your 64 will think that {HOME} and RETURN have been pressed and will add the line to the program.*

If you'd like to run the program again after the line has been added to memory, just add another 13 to the keyboard buffer (POKE 633,13) and put a 3 into 198 instead of a 2. Plus, you'll have to print RUN a couple of lines below the new line 190.

The computer will add the line to memory, and then you'll have to press RETURN over the RUN command, which will restart the program. Some programmers prefer to print the characters in the same color as the screen by executing **POKE 646, PEEK(53281)** *before the dynamic keyboard technique is used, just to make the screen look a little neater.*

A Fifth File Type

I was reading my disk-drive manual and discovered that by changing the directory load command, I could list just certain file types. For example, to load only SEQ or PRG file types, you could type

```
LOAD "$0:*=S",8
LOAD "$0:*=P",8
```

Of the choices given, one was *D* for deleted files. The above examples worked, but when I tried using a *D*, it loaded the regular directory. Why doesn't this work?

Dallas Plattsmeier

Most Commodore owners have seen PRG and SEQ files, which usually contain programs and sequential data files, respectively. Another fairly common file type is REL, which contains information in a relative (random access) file. Once in a while, you'll also see a USR file. USR files usually hold programs or data, and once in a while they'll hold a program that runs inside the disk drive's memory.

The fifth file type, which you'll almost never see is DEL (for DELeted files). Note that this is not the same as a scratched file. To create a DEL file, run the following program:

```
10 OPEN 2,8,2,"HELLO,S,W"
20 OPEN 3,8,3,"HELLO,S,W"
30 PRINT#2: PRINT#3
40 CLOSE2: CLOSE3
```

Save it to disk if you wish. If you now load the directory, with **LOAD"$0",8** *you'll see two files with the same name (HELLO). One is DEL, one is SEQ. There's no reason to use DEL files, however. They're available, but don't really serve any purpose.*

Also, we tried **LOAD"$0:*=D",8** *and it didn't seem to pick up deleted files, although* S *and* P *did work with SEQ and PRG files.*

Memory Locations And Ports

I was wondering if you could give me the memory locations for the user port, the cartridge expansion port, the cassette port, the serial port, the composite video connector, and the RGBI connector for the 128, so that I may use them in a program.

Jason Grizzle

There are basically three types of memory inside your 128: random access memory (RAM), read only memory (ROM), and registers that control the actions of support chips. RAM can be changed; you can PEEK it to see what's there or POKE it to change the number in memory. You can only PEEK ROM. If you try to POKE to a ROM location, its value will remain the same and, on the 64 and 128, another memory location will be changed in the RAM "underneath" the ROM.

Chip registers act as if they're RAM. You can usually PEEK and POKE them (except the SID chip), but they're not memory in the sense that RAM and ROM are memory. For example, the POKE that turns on the hi-res screen doesn't really change a memory location; it writes a value to a register inside the VIC chip, which changes its internal state to switch screen output to hi-res. The SID chip is unusual because you can POKE to various registers, but if you PEEK, the values will often differ from the number you POKEd.

Most of the ports you've asked about, the various connectors on the back of the computer, aren't directly addressable as memory locations. The input and output ports are controlled by various I/O chips within the computer.

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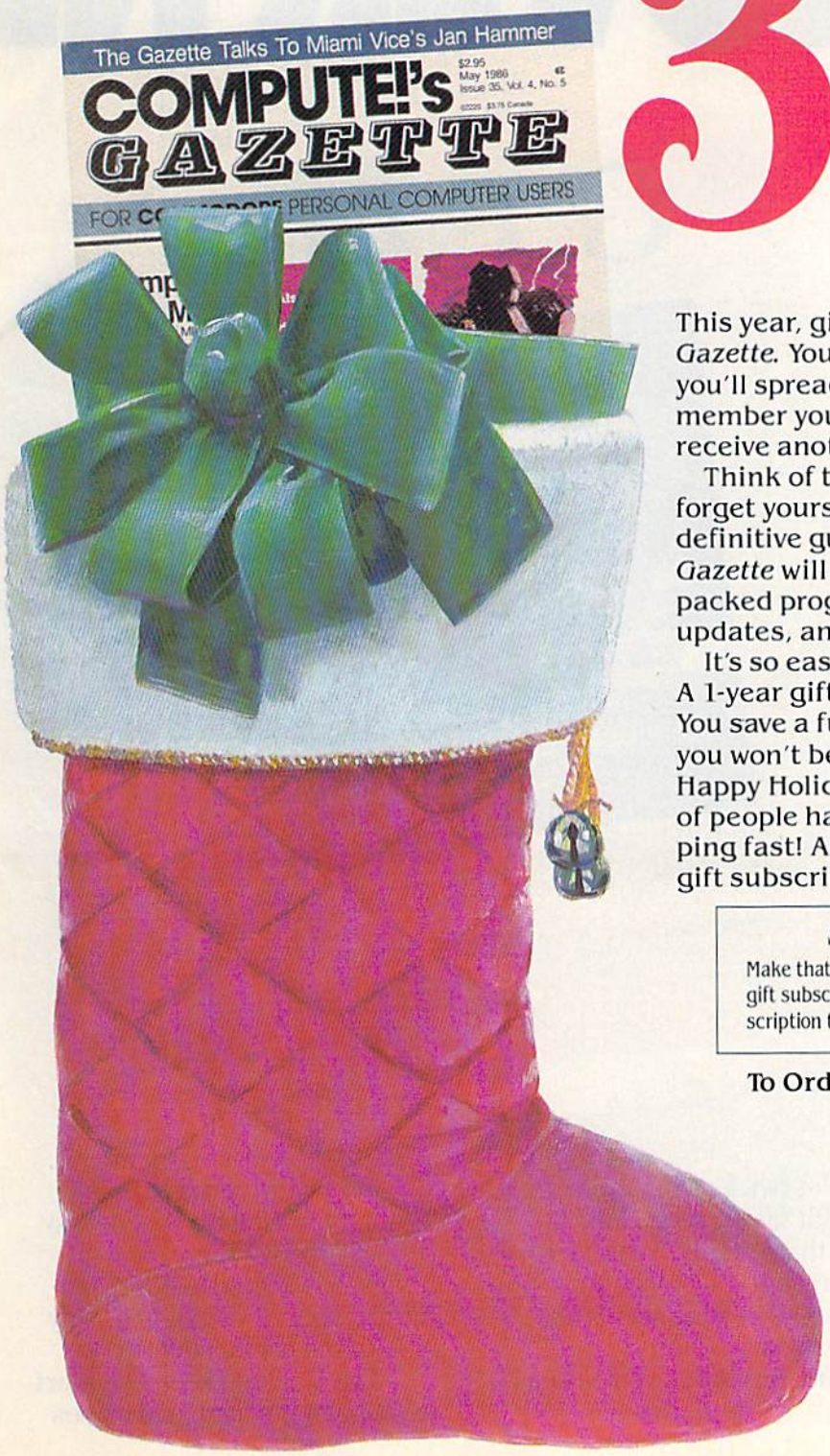

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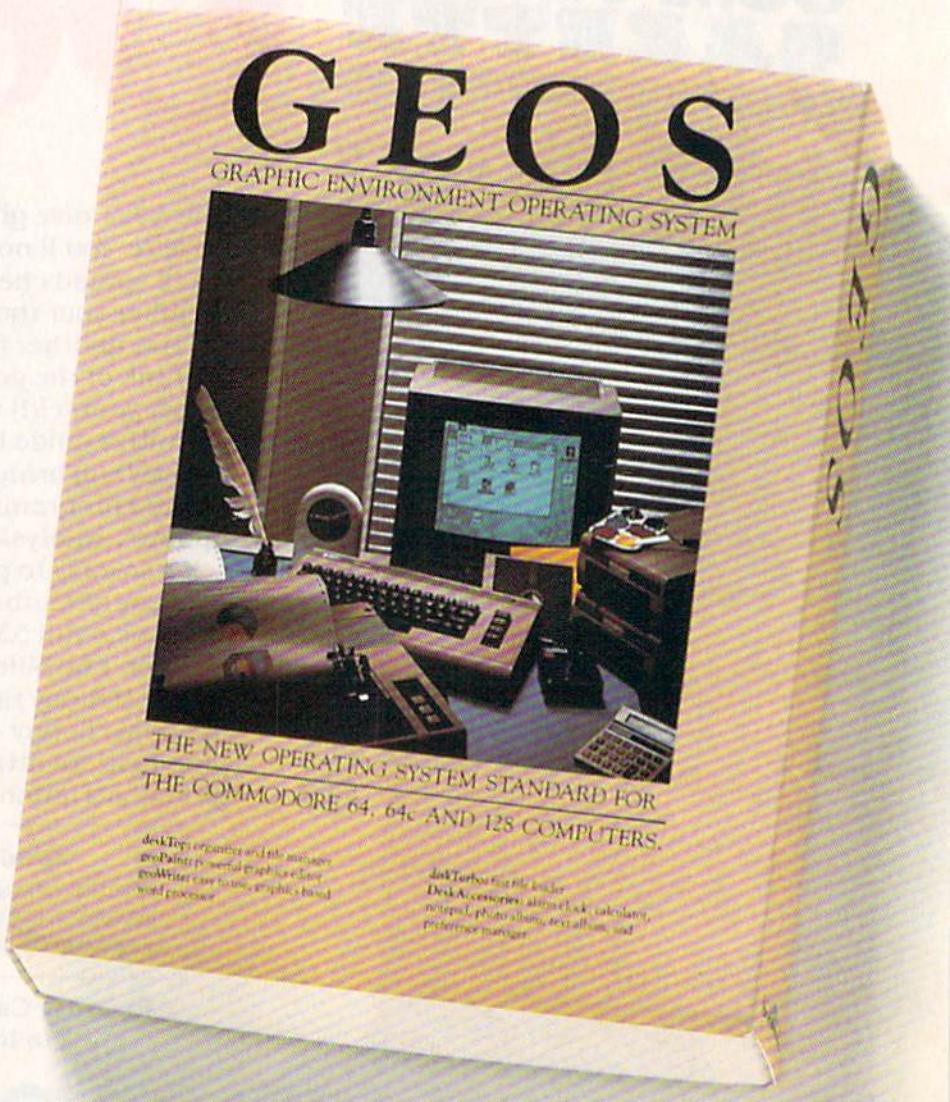
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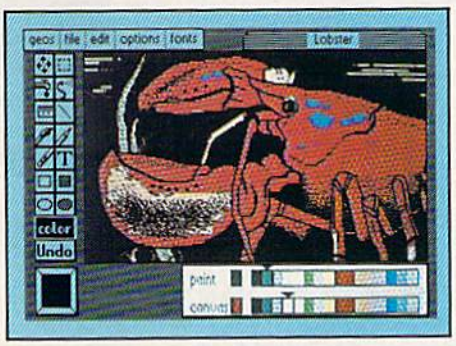

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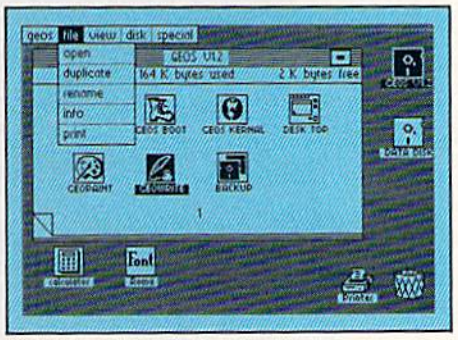

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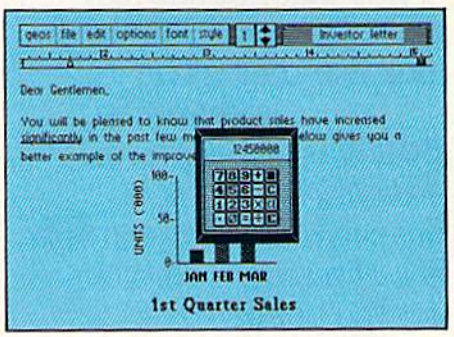

And if he looks at you like you're some kind of alien, well, just tell him Berkeley Softworks sent you.

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better, it practically speaks for itself.

Look what we found in your desk. You know how there's always one drawer in your desk that's filled with really neat stuff? Well, GEOS has one of those, too.

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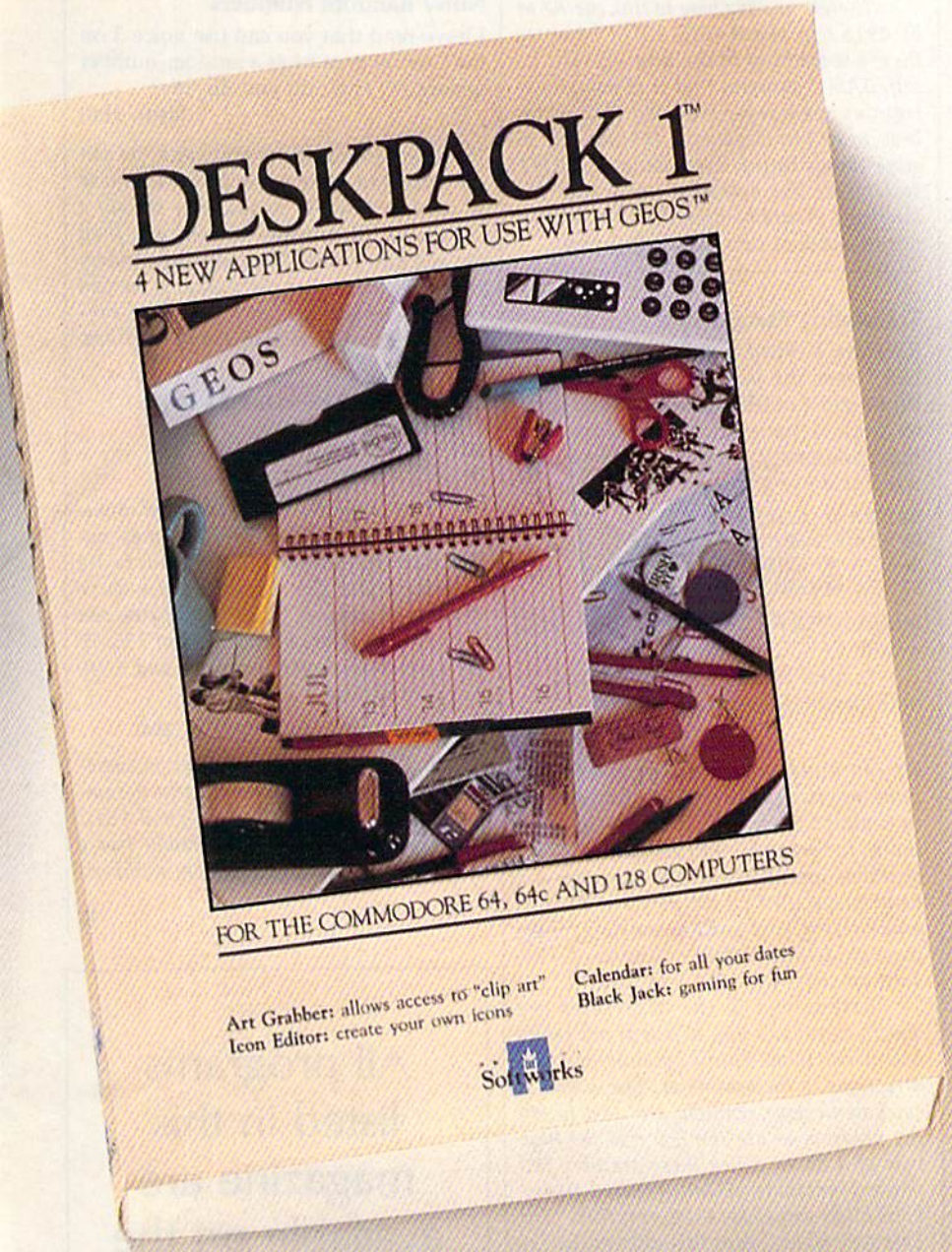
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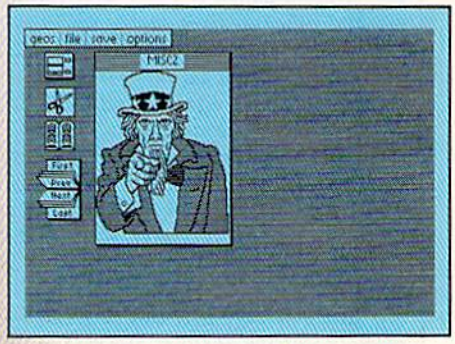

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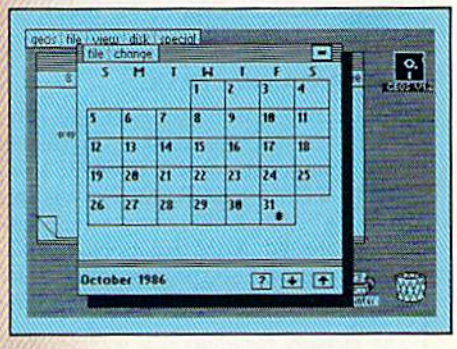

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The composite video port puts out three signals: chroma, luma, and audio. To change the audio output, you must POKE to the SID chip which is in charge of music and sound. To change chroma, you POKE to color memory and to the various color registers within the VIC chip that define multicolors and sprite colors. To change luma, POKE to screen memory and/or character memory (if you're using custom characters) or to hi-res memory (in hi-res mode) or sprite shapes, wherever they may be at the time.

The RGBI port's output is in the jurisdiction of the VDC chip, to which you can POKE to affect what's happening on the 80-column screen.

The user port can be addressed as device 2. It's most often used for connecting a modem, although you can attach printers and other devices there. You would OPEN 2,2 (plus various secondary addresses and additional information), then PRINT#2 to send a signal and INPUT#2 or GET#2 to retrieve data.

The cassette port is device 1. The serial port can control devices 4–255 (usually printers or disk drives). You can OPEN a channel to either of these and then INPUT# and GET# to read; PRINT# to write.

The cartridge port can be treated as memory starting at either $8000 or $C000 (in both 64 and 128 modes). To create your own cartridge, you need something called an EPROM burner, which creates an electrically programmable ROM chip.

If you're interested in experimenting with electronics projects involving the 64, we can recommend Electronic Computer Projects for Commodore and Atari Computers *from COMPUTE! Books.*

The RAM Under BASIC

I have two questions. First, the *Programmer's Reference Guide* for the 64 says that locations 40960–49151 are BASIC ROM or 8K RAM. How is this possible? Also, is there any way to link the protected RAM locations 49152–53247 to the BASIC programming area?

Jason DeStefano

The memory locations you mention hold either the BASIC ROMs or RAM (for your own program)—but not both at once. The RAM is said to be "under" the ROM because when you turn on the computer the ROM is switched in automatically. You can POKE to the RAM here, but you can't read it without turning off BASIC, which can be accomplished by typing POKE 1, PEEK(1) AND 254. However, this will crash your computer because the POKE turns off BASIC completely. Without BASIC, your computer can't communicate with you. This technique is useful mostly for machine language programmers who need the extra RAM, but don't need the BASIC interpreter. Some programs copy BASIC from ROM to RAM to make changes in the BASIC interpreter itself. These changes last until power is turned off or until RUN/STOP–RESTORE is pressed. The operating system (locations 57344–65535) also has RAM underneath it.

There's no easy way to link the RAM at 49152 to the BASIC RAM because there's something in the way—BASIC itself. BASIC assumes that it is using contiguous memory—memory that's not broken up into segments. It's possible to store things in this area using the POKE statement, but beware—many machine language programs (like the DOS Wedge) put themselves into this "safe" area.

Translating Pseudo-ops

Recently I typed in "The Fast Assembler" from the January 1986 GAZETTE. While most of the ML commands seem to work, I have stumbled across one that continually produces a syntax error which I don't know how to fix:

```
54 LDA #<CHRBAS
55 STA MVSRCE
56 LDA #>CHRBAS
57 STA MVSRCE+1
```

where CHRBAS=$D000, MVSRCE =$FB.

In this example, lines 54 and 56 both produced syntax errors.

Pat McConville

We can divide machine language operations into two categories. The first category contains operation codes (op-codes for short); the second group contains pseudo-operands (pseudo-ops). The op-codes are usually specified by the maker of the microprocessor, and most assemblers follow these guidelines closely. Examples of standard op-codes are LDA and STA.

Extensions to the assembler are known as pseudo-ops, which aren't really ML instructions. Rather, pseudo-ops give directions to the assembler. The < and > symbols in your example are used to tell the program to use the low and the high byte of a value. Since these are very important functions, all full-featured assemblers allow some way to express this. "The Fast Assembler" does this differently. Try this:

```
54 LDA #CHRBAS - (INT(CHRBAS/
   256) * 256)
55 STA MVSRCE
56 LDA #INT(CHRBAS/256)
57 STA MVSRCE+1
```

Since these operators are so common, you might want to define functions L and H and use them instead.

```
10 DEF FN H(X)=INT(X/256)
20 DEF FN L(X) = X - (256 * FNH(X))
54 LDA #FN L(CHRBAS)
55 STA MVSRCE
56 LDA #FN H(CHRBAS)
57 STA MVSRCE+1
```

*Other pseudo-ops may differ between assemblers. Some assemblers use *= to give the starting address, others use .ORG. Some use DB to define bytes, others use .BYTE.*

Noisy Random Numbers

I have read that you can use voice 3 on the Commodore 64 as a random-number generator. How do you do this?

Jason Hall

The idea behind this is that since we can set voice 3 to make noise, and since noise as produced by the computer is simply a succession of random frequencies, then the computer must be producing random numbers somewhere. Fortunately, we can read the register which holds these random numbers. Here's an example of how it's done:

```
10 POKE 54287,255:POKE 54290,128:
   POKE 54296,128
20 PRINT PEEK(54299)
30 GOTO 20
```

This program prints random numbers until you press STOP. You may notice that all the random numbers lie between 0 and 255. That's because we're looking at random bytes, and bytes can only hold numbers between 0 and 255. To get a random integer between 0 and 9, try this line instead:

```
20 PRINT INT(PEEK(54299)*10/256)
```

Reading the noise register is sometimes used in machine language programming, but is rarely seen in BASIC programs because BASIC already has a function for generating random numbers.

All programs listed in this magazine are available on the GAZETTE Disk. See details elsewhere in this issue.

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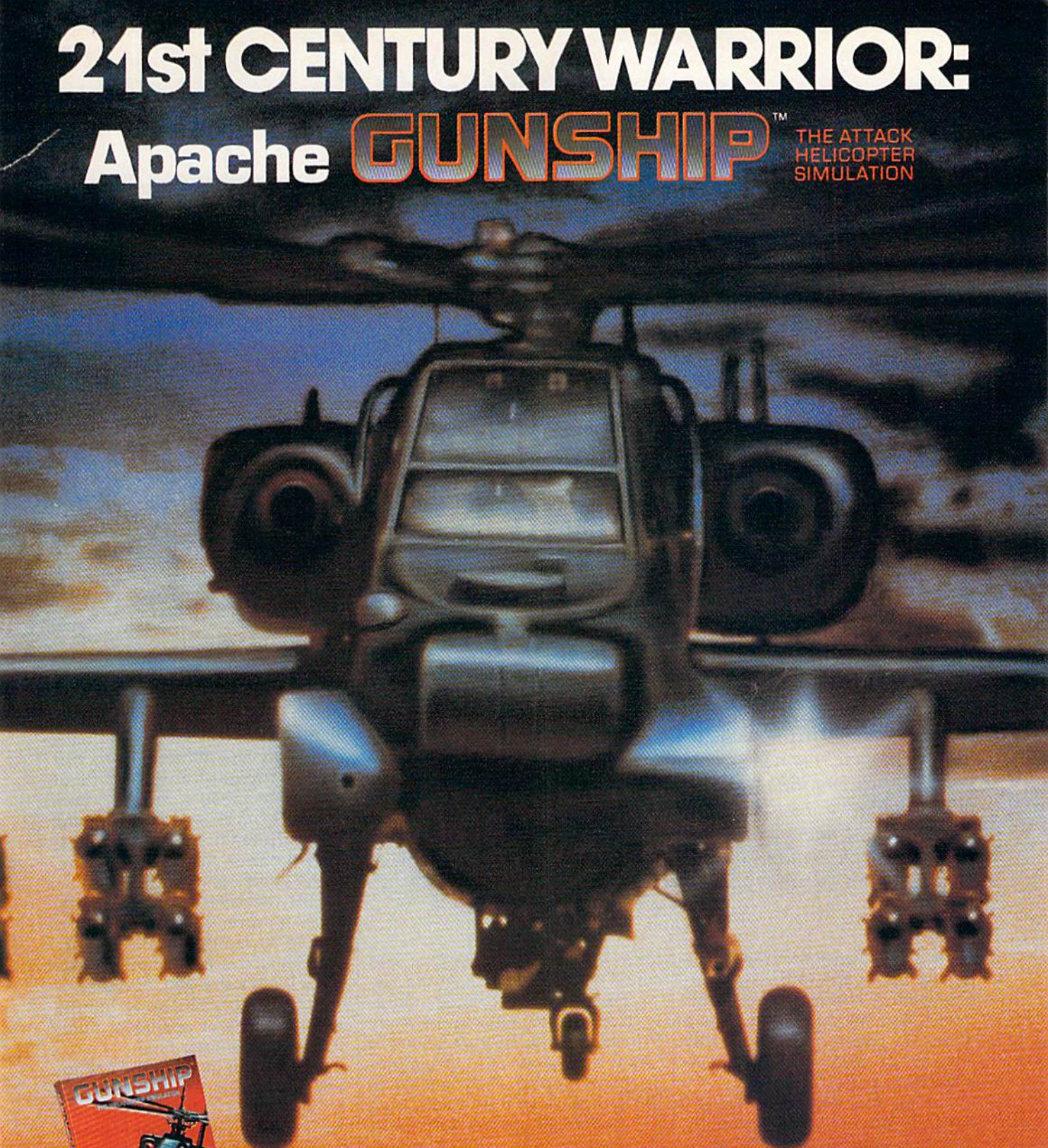

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Selby Bateman, Features Editor

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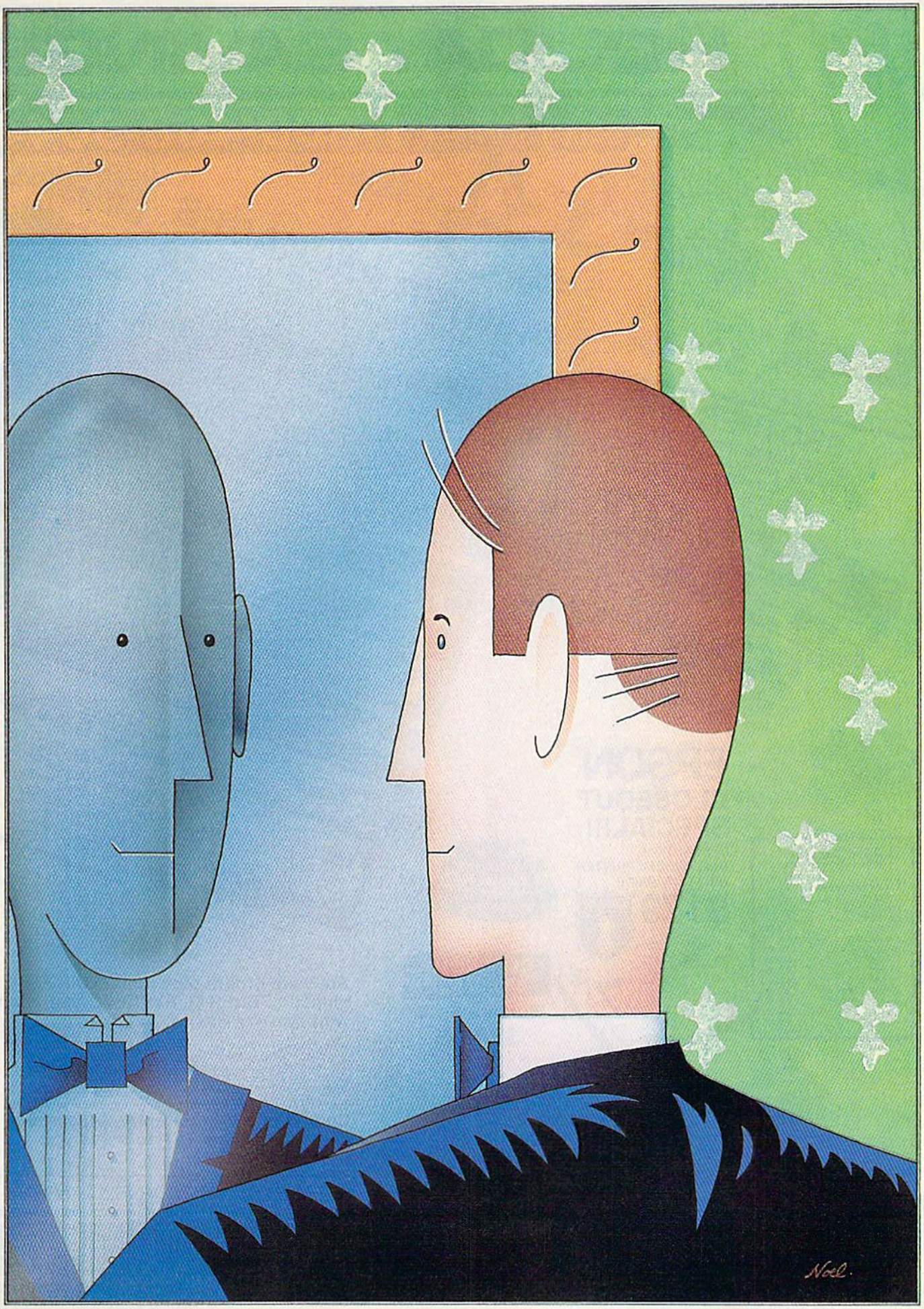
All of these potentially dangerous and costly situations are simply computer simulations, digital models of real life. Simulating the real world is a task that computers have been doing since the days of the early mainframe computers. There's nothing more going on at the core of these simulations than *number crunching*—the processing of millions of different instructions in seconds.

As computers have grown more powerful—with larger memories and improved graphics and sound—the range of things that can be simulated has expanded radically. The first simulations were really just statistical what-if situations in which a given set of numbers produced its results when applied in different ways. In this respect, even a computerized spreadsheet can be considered a good what-if simulator. That's how it's most often used in financial modeling, and the spreadsheet today is regularly used to assist in making business decisions. Yet computers now allow far more to be simulated: not just numbers, but the visual and aural representation of those numbers as well. Computer-aided design (CAD), for example, can include a computer-generated construction so lifelike it almost seems real. Large mainframe computers and minicomputers that control the most advanced flight simulators produce realistic views from the mock cockpit, including three-dimensional landscapes, shaded objects that can also move, sound effects, and much more.

At the heart of these simulations, however, is the same basic numerical manipulation that accompanied the first computer modeling. What's changed, of course, is the computer's ability to handle many millions of additional numbers in a far shorter time.

Computer modeling and simulations are used extensively today by the armed forces in order to teach personnel to operate sophisticated equipment without the expense and danger of using the real thing. Engineers, architects, chemists, and many other professionals can experiment with simulations that would have seemed like magic just ten years ago.

While the Commodore 64 or 128 obviously doesn't have the power of the giant mainframes and minicomputers, it does offer a rich environment for certain kinds of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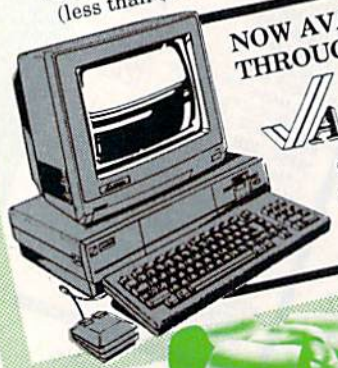

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simulations. And software developers have been quick to discover just how flexible this Commodore 64 environment can be.

Flight, Sports, And History

There are several different kinds of simulations available for the 64 and dozens of examples within these categories. For the most part, Commodore simulations fall into three categories: realtime, sports, and historical. Although just about any activity can be simulated, these three categories have generated the most interest among Commodore owners.

Among the realtime simulation programs available for the 64, flight simulators are the most popular. A quick look at "A Buyer's Guide to Commodore 64 Simulation Software," accompanying this article, shows just how many of the simulations are based on flying.

Some of them, such as SubLOGIC's *Flight Simulator II*, MicroProse's *F-15 Strike Eagle*, and Microsoft's *Flight Simulator*, have been on software best-seller lists for a year or two and show no signs of disappearing.

Although the first commercial flight-simulation machine was created and used as far back as 1929, it wasn't until the mid-1970s that computers actually became powerful enough to allow simulation systems based on computerized images. Now, little more than a decade later, the flight simulators available for the Commodore 64 and 128 surpass the capabilities of the mainframe systems used in the 1970s.

What's the allure of these flying simulations? The chance to experience the thrill of flying—without the expense and danger—is a powerful attraction in this airborne age. But the flight-simulation packages also offer much more. When you're in the cockpit of a World War II fighter or bomber, and are given a variety of specific challenges, suddenly the simulation is also a game.

Although most of these games trade off differing degrees of realism for easier and more interesting game play, there seems to be something for just about everyone—from the would-be pilot who wants nothing but realism to the game buff who's willing to sacrifice a bit of the rigors of flying in order to enjoy the entertainment of combat simulations.

In fact, a new genre is emerging based on these flight simulators. Two recent best-selling books, *40 Great Flight Simulator Adventures* and its sequel, *40 More Great Flight Simulator Adventures*, (COMPUTE! Books) offer custom-made flying excursions complete with sightseeing and flying adventures.

But flight's not the only subject of realtime simulations for Commodore owners. MicroProse Software, which produces more realtime simulations than any other software publisher, also offers you the chance to command a submarine, an attack helicopter, an acrobatic jet, and even an airport control tower.

MicroProse, which prides itself on the realism of its simulation programs, even offers its *F-15 Strike Eagle* owners the chance to recreate the April 1986 bombing attack by American F-111's against Libya. But, as the company's ads have stated, "the best part is...no one gets hurt."

Sports and historical recreations are also among the most popular topics for Commodore simulation programs. Almost any listing of the top-20 best-selling Commodore entertainment software will reveal that almost half of the products fall into the categories of realtime, sports, or historical simulations.

Most of the historical simulations available for Commodore owners are based on strategy war games, a genre that grew out of the earlier board games before the emergence of computers. Dominating this category is Strategic Simulations (SSI), which has some 30 computer strategy games in its Commodore product line. The subjects range from up-to-date themes such as *Germany 1985* and *Geopolitique 1990* to such historical topics as the Old West recreation, *Six-Gun Shootout*, and the Civil War's *Battle of Antietam*.

A variety of other companies also offer strategic war games, including MicroProse, Avalon Hill, and SSG. Although World War II forms the backdrop for most of these strategy games, just about any period of history can be targeted. Vietnam, for example, is the subject of a growing number of games, including MicroProse's *Conflict in Vietnam* and SSI's *NAM* (see review elsewhere in this issue).

Sports simulations for the Commodore 64 usually fall into one of two categories: arcade-action games, in which fast reflexes with a joystick are paramount, and strategy games, which are closer in style to war games.

An entire series of popular fast-action sports games, originally based on Olympic events such as pole vaulting, track, and swimming, has been produced by Epyx. *Summer Games* and its sequels (*Summer Games II*, *Winter Games*, and *World Games*) feature a variety of contests in each package, colorful graphics, and sound effects.

Others in this genre have concentrated on different sports. Access Software's *Leader Board* is an action golf simulation and Accolade's *Hardball* is an action baseball simulation. There are karate simulations that have grown out of the popularity of martial-arts instruction, including Data East's *Karate Champ* and *Kung Fu Master*, and Epyx's *World Karate Championship*.

In fact, as a glance at the accompanying guide to simulations shows, just about any sport, from bowling and boxing to football and tennis, can be the subject of a simulation game.

Sports strategy games for the Commodore 64 have often evolved from earlier board games in much the same manner as the computerized war games. With baseball and football fans eager to recreate their favorite teams and seasons, the strategy games in these two areas have fared especially well.

SubLOGIC's *Football* and the new *Pure-Stat Baseball*, Epyx's *The World's Greatest Baseball Game*, and Gamestar/Activision's *Championship Baseball '86* are just a few of the popular sports simulations.

Although new simulations—realtime, historical, and sports—crop up every day, Commodore owners always seem ready for one more good program in their particular areas of interest. Other topics haven't generated as much enthusiasm in the Commodore market as these three. But with an installed base of several million 64s and 128s, there are likely to be new categories and topics available in the future.

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A Buyer's Guide To Commodore 64 Simulation Software

Prices for the following simulation programs generally range from about $20 to $50, depending on the company and the product.

Ace of Aces
Accolade—This World War II aerial-warfare game lets you pilot an RAF Mosquito in the skies over Europe.

Acro-Jet
MicroProse—Up to four players compete in aerial acrobatics in a simulated BD5-J one-man jet.

The American Challenge: A Sailing Simulation
Mindscape—A sailing simulation that lets you learn the rudiments of sailing and then compete for the America's Cup.

Baltic 1985
SSI—Part of SSI's When Superpowers Collide strategy series; NATO forces attempt to rescue troops trapped in West Berlin.

Battalion Commander
SSI—A realtime strategy game as you command U.S., Soviet, or Chinese troops.

Battle for Normandy
SSI—You're in command of the Allied forces on D-Day in World War II in this strategy game.

Battlefront
SSG/Electronic Arts—You're a corps commander in World War II in this recreation of four major land battles in Crete, Stalingrad, Saipan, and Bastogne.

Battlegroup
SSI—A strategy game depicting armored combat on the Western Front in World War II.

Battle of Antietam
SSI—A strategy game recreating the famous Civil War battle.

Breakthrough in the Ardennes
SSI—A detailed recreation of the Battle of the Bulge during World War II.

Broadsides
SSI—In this strategy game, you're the captain of an eighteenth-century warship during the age of fighting sail.

Carrier Force
SSI—This is a simulation of four major naval battles between the U.S. and Japan in the Pacific.

Carriers at War
SSG/Electronic Arts—A recreation of the crucial naval battles in the Pacific during World War II.

Cartels and Cutthroats
SSI—A business simulation that lets you run a major corporation.

Championship Baseball '86
Gamestar/Activision—A new major league baseball simulation game.

Championship Golf at Pebble Beach
Sportsware—A professional golf simulation, with a choice of 14 different clubs, two skill levels, and optional data disks for two more courses.

Colonial Conquest
SSI—A strategy game of world domination set during the Age of Imperialism in the late nineteenth and early twentieth centuries.

Combat Leader
SSI—You can take command as company commander, platoon leader, or squad leader in this strategy simulation of tank warfare.

Computer Ambush
SSI—In this simulation, you take charge of ten American or German soldiers in hand-to-hand combat.

Computer Baseball
SSI—A strategy game featuring major league baseball teams, with optional team disks for different years.

Computer Quarterback
SSI—A strategy game featuring major league football teams, with optional team disks for different years.

Conflict in Vietnam
MicroProse—Five different battle scenarios from the Vietnam War are covered in this strategy game.

Crusade in Europe
MicroProse—From D-Day to the Battle of the Bulge, you're in command in this World War II strategic simulation game.

Decision in the Desert
MicroProse—A strategic recreation of warfare in North Africa during World War II.

Destroyer Escort
MicroProse—The waters of the North Atlantic are the battleground for this strategic simulation of convoy-escort situations in World War II.

Dreadnoughts
Avalon Hill—It's the Royal Navy versus the awesome German Bismarck in this World War II naval-strategy game.

Eagles
SSI—You're the pilot of such World War I planes as the Sopwith Camel or the Fokker Triplane in this aerial-combat simulation.

Europe Ablaze
SSG/Electronic Arts—This is a simulation strategy game of the air war over England and Germany during World War II.

F-15 Strike Eagle
MicroProse—A sophisticated and popular jet-fighter flight simulator with combat scenarios, including the April 1986 bombing raid on Libya.

Field of Fire
SSI—This strategy game puts you in command of Easy Company in eight historical battles of World War II.

Fighter Command
SSI—A detailed air-combat strategy game about the Battle of Britain during World War II.

Fight Night
Accolade—This action boxing game includes a construction set that lets you build your own fighters.

Flight Simulator II
SubLOGIC—This is a realistic flight-simulation program that features a variety of scenarios and options.

Football
SubLOGIC—A realistic football simulation that features both strategy and action.

GATO
Spectrum Holobyte—A World War II submarine simulation, with eight different missions, five difficulty levels, and three ships.

GBA Championship Basketball
Gamestar/Activision—A two-on-two fast-action basketball simulation with a four-division, 23-team league.

Geopolitique 1990
SSI—A political, economic, and military strategy game in which you battle the computer for world dominance.

Germany 1985
SSI—The first game in SSI's When Superpowers Collide series; you're in charge of NATO forces repelling an attack by Warsaw Pact troops.

Gettysburg: The Turning Point
SSI—Basic, intermediate, and advanced levels of play are a part of this historically accurate recreation of the famous battle of Gettysburg in the American Civil War.

Guderian
Avalon Hill—This is a simulation of the German campaign in Russia during World War II, recreating the 1941 attack on Smolensk.

Gulf Strike
Avalon Hill—A strategic simulation of land, sea, and air war in the Middle East.

Gunship
MicroProse—A realistic simulation of the Apache AH-64A attack helicopter, with advanced offensive and defensive weaponry.

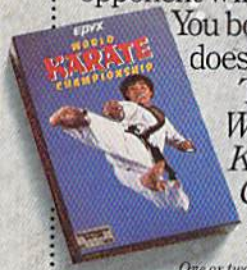
The Halley Project: A Mission in Our Solar System
Mindscape—An educational realtime simulation of the solar system, with missions for players to undertake.

Hardball
Accolade—A fast-action graphically oriented baseball simulation.

Hellcat Ace
MicroProse—This is an aerial-combat simulation among fighter planes in the Pacific Theatre during World War II.

Continued

You smirk. Your opponent winces. You bow. So does he. The *World Karate Championship*™ begins.



One or two players. Apple II & compatibles, Atari 800/130, C64/128, IBM & compatibles.

Slowly, ever so slowly, you approach. He flinches, and you make a combination front punch and kick.

You spin, then do a reverse kick. A forward flip. You kick again, only higher. Bang. It connects. Lights out.

Practice long enough and your fingers will be registered as lethal weapons.

This time, you survived in one piece.

You'll have 17 intricate moves to master.

As you progress, you'll fight your way from white to black belt in 8 deadly, international settings. With a final, championship match at the base of Mt. Fuji.

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These animals use every trick known to man. And a few that aren't.

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Throw them from the ring. Crush their heads. Slam them to the mat. Pulverize their puny bones. You'll have over 25 moves to pin your man. You'll need over 250 stitches if you don't.

And one day, after your poor battered head resembles an over-cooked cabbage, you'll be good enough to win the title. And the Championship Wrestling Belt will be yours.

EPYX®

One to eight players. Apple II & compatibles, Atari ST, C64/128.

Jet
SubLOGIC—You pilot one of two jet fighters through a variety of scenarios.

Jet Combat Simulator
Epyx—A flight simulator based on the McDonnell Douglas F-15 Eagle that includes flight scenarios and air-to-air combat.

Kampfgruppe
SSI—Warfare on the Russian Front during World War II is the subject of this strategy simulation.

Karate Champ
Data East—An arcade-action martial-arts simulation game.

Kennedy Approach
MicroProse—A realistic air traffic-control simulation that includes speech synthesis and a variety of air-control situations.

Knights of the Desert
SSI—This is a strategy simulation of the tank warfare in North Africa during World War II.

Kung-Fu Master
Data East—An arcade-action martial-arts simulation game.

Leader Board
Access—A golf simulation game featuring excellent graphics and sound effects.

Mech Brigade
SSI—A strategy simulation of armored warfare during the 1990s.

MIG Alley Ace
MicroProse—You're in command during sabre-jet aerial dog fighting in an air-to-air combat simulation.

Monday Morning Manager
TK Computer Products—A strategy baseball simulation with 64 major league teams and over 1500 players and pitchers.

NAM
SSI—This is a combat simulation game set in the jungles of Vietnam.

NATO Commander
MicroProse—Take charge of NATO and defend Europe against a Soviet invasion in this strategic simulation game.

Norway 1985
SSI—The last strategy simulation in SSI's When Superpowers Collide series; NATO guerrillas battle Soviet armor in Norway.

On-Court Tennis
Gamestar/Activision—An action tennis simulation game.

On-Field Football
Gamestar/Activision—An action football simulation game.

Operation Market Garden
SSI—You command the Allied airborne divisions during the 1944 effort to secure six bridges that will allow your troops to cross into Germany.

Operation Whirlwind
Brøderbund Software—A battle action game at the battalion level during World War II.

Panzer Grenadier
SSI—A strategy simulation of warfare on the Eastern Front during World War II, with you in command of German elite armored infantry.

Panzers East!
Avalon Hill—A strategy game recreating warfare on the Eastern Front during World War II.

President Elect
SSI—An educational simulation that lets you manage a nine-week campaign for the Presidency.

Professional Tour Golf
SSI—An action simulation of professional golf.

Pro-Golf
Mastertronic—An action professional golf simulation.

Pure-Stat Baseball
SubLOGIC—Baseball statistics fans can have a field day with this major league baseball simulation.

Rails West!
SSI—You're trying to wheel and deal your way to building a transcontinental railroad in this nineteenth-century business simulation.

RDF 1985
SSI—One of the When Superpowers Collide series from SSI; you command the U.S. Rapid Deployment Force in retaking Soviet-captured oilfields in the Middle East.

Ringside Seat
SSI—An action simulation of professional boxing that allows you to match the pros from past and present.

Silent Service
MicroProse—You're the commander of a submarine in this naval-combat simulation set in the Pacific during World War II.

Six-Gun Shootout
SSI—Direct the actions of Billy the Kid, Wyatt Earp, and other gunslingers in this action strategy game.

Solo Flight
MicroProse—A recently updated flight simulator that includes an instructor-pilot option, software speech synthesis, and new take-off and landing maps.

Space Shuttle
Activision—Subtitled *A Journey into Space*, this is a realistic space-flight simulation based on the space shuttle.

Spitfire Ace
MicroProse—This is an aerial-combat simulation among fighter planes in the European Theatre during World War II.

Spitfire 40
Avalon Hill—A World War II aerial-combat game in which you pilot a Mark I Supermarine Spitfire.

Star League Baseball
Gamestar/Activision—An action baseball simulation game.

Star Rank Boxing
Gamestar/Activision—A fast-action boxing simulation that lets you build up your skills in training camp and then go for the championship.

Statis Pro Baseball
Avalon Hill—A strategy simulation of professional baseball.

Summer Games
Epyx—A fast-action sports game that simulates eight key Olympic events.

Summer Games II
Epyx—A fast-action sports game that simulates eight new Olympic events.

Super Bowl Sunday
Avalon Hill—You're the coach in this professional football simulation that includes 20 different Super Bowl teams; a separate season disk is available also.

TAC
Avalon Hill—Tactical Armor Command, a simulation of World War II armored combat.

10th Frame
Access—A bowling simulation game featuring colorful, detailed graphics.

Tigers in the Snow
SSI—A recreation of the German offensive at the Battle of the Bulge during World War II.

Title Bout
Avalon Hill—A professional boxing simulation game.

Tournament Golf
Avalon Hill—A professional golf simulation game.

USAAF
SSI—A strategy game that recreates the daylight bombing of Nazi-occupied Germany by the United States Army Air Force during World War II.

Wings of War
SSI—Four scenarios in this World War II aerial-combat game let you pilot 36 different fighters and bombers.

Winter Games
Epyx—A fast-action sports game that simulates such winter sports as ski jumping, speed skating, figure skating, and others.

World Games
Epyx—A simulation of eight athletic contests from around the world.

World Karate Championship
Epyx—A fast-action karate simulation that lets players practice and use up to 17 different moves against opponents.

The World's Greatest Baseball Game
Epyx—A recently enhanced version of a strategy sports simulation that features over 75 baseball teams and complete player rosters from the 1984 and 1985 major league seasons.

The World's Greatest Football Game
Epyx—A strategy sports simulation that lets you be both player and coach, designing your own plays and then running them.

Access Software
#A 2561 South 1560 West
Woods Cross, UT 84087

Accolade
20833 Stevens Creek Blvd.
Cupertino, CA 95014

Activision
2350 Bayshore Frontage Rd.
Mountain View, CA 94043

Avalon Hill Game Company
Microcomputer Games Division
4517 Harford Rd.
Baltimore, MD 21214

Brøderbund Software
17 Paul Dr.
San Rafael, CA 94903

Data East USA
470 Gianni St.
Santa Clara, CA 95054

Electronic Arts
1820 Gateway Dr.
San Mateo, CA 94404

Epyx
1043 Kiel Ct.
Sunnyvale, CA 94089

Firebird Licensees
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Ramsey, NJ 07446

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New York, NY 10017

Mastertronic International
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Frederick, MD 21701

MicroProse Software
120 Lakefront Dr.
Hunt Valley, MD 21030

Mindscape
3444 Dundee Rd.
Northbrook, IL 60062

Spectrum Holobyte
1050 Walnut
Suite 325
Boulder, CO 80302

Spinnaker Software
One Kendall Square
Cambridge, MA 02139

Sportsware
5234 War Wagon Dr.
San Jose, CA 95136

Strategic Simulations (SSI)
1046 N. Rengstorff Ave.
Mountain View, CA 94043

SubLOGIC
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Spinnaker Software
One Kendall Square
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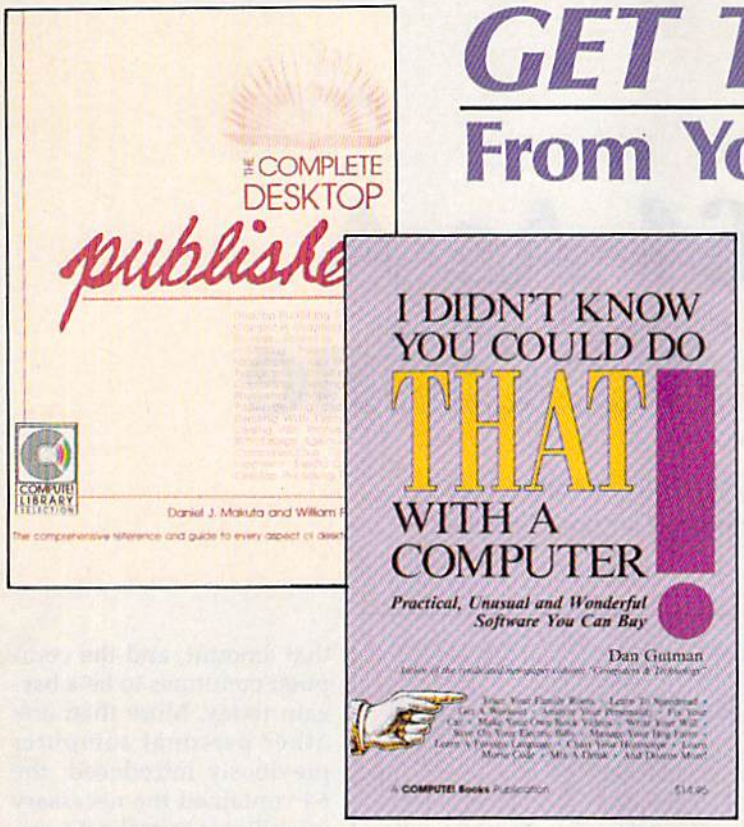

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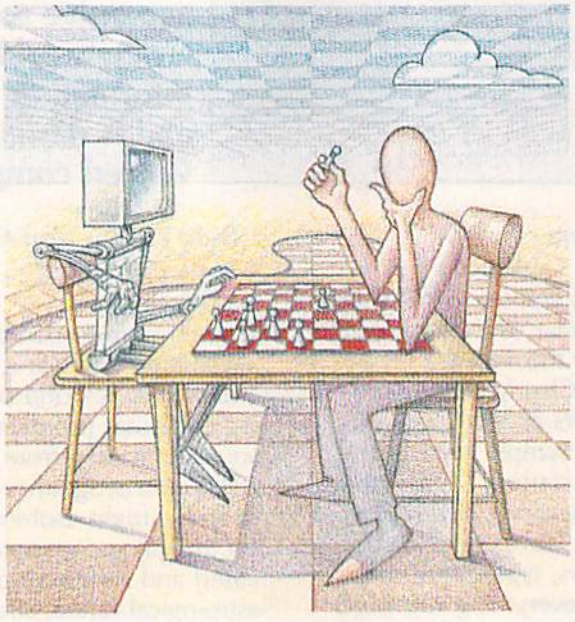
The 64 As A Game Machine

Kathy Yakal, Assistant Features Editor
Selby Bateman, Features Editor



Almost five years after its introduction, the Commodore 64 continues to be the most popular game machine on the market thanks to its excellent color graphics and three-voice sound chip. This year, numerous software publishers have announced a spate of new entertainment programs for the 64, pushing the machine to even greater capabilities. Here's a look at some of those new products.

Despite the fact that the microcomputer industry got much of its start from the early arcade-game machines and that millions of people bought VCS (video cartridge system) games, many computer users today reserve the term *game machine* as an epithet for a computer with little power.

Happily, Commodore 64 owners have known for a long time that their machines give them the best of both worlds. And the latest 16-bit computer powerhouses like the Commodore Amiga and Atari ST substantiate the fact that a computer can be both a workhorse and an entertainment center.

When the first personal computers began appearing in the late 1970s, there simply wasn't enough power in the machines to generate sophisticated graphics and sound. Hobbyists, programmers, and some small-business owners were thankful just to have the raw computational power in the early Apple, Radio Shack, Commodore PET, Texas Instruments, and other computers. Although games were written and sold for all the early computers, the limited memory and relatively bare-bones hardware made them less than ideal game machines.

Then came the Commodore 64. Though its initial price was near $600, Commodore steadily dropped the price to less than half that amount, and the computer continues to be a bargain today. More than any other personal computer previously introduced, the 64 contained the necessary ingredients to make it a terrific game machine: a three-voice programmable sound chip called SID (Sound Interface Device) that's been described as a synthesizer on a chip, and a color graphics system that includes *sprites*, independently movable objects that overlay the background display.

As sales of the 64 took off during late 1982 and early 1983, software developers responded. Scores of software packages began appearing, and many of them were entertainment programs. But programmers were just beginning to learn that the Commodore 64 offered a development environment too rich to be fully exploited overnight. Today, with some five million 64s sold, game designers have hit their stride. Programmers have learned the 64 inside and out, and are creating sound and graphics effects that the computer's designers would never have dreamed possible.

"The 64 combines the best graphic resolution, the best music

Introducing ActionSoft!

Colonel Jack Declares War to Improve Strategy/Action Software

Colonel Jack Rosenow, President of ActionSoft Corporation, is out to turn the simulation software industry upside down:

"Most current simulations are little more than games," says the Colonel. "They're a far cry from what can be done with modern state-of-the-art graphics technology. They have limited strategic depth and a limited sense of realism. That's why ActionSoft Corporation was created. We're going to redefine the state of the art in simulation software.

"My own area of expertise is military helicopters - their flight characteristics, and their deployment on the battlefield. We've assembled a collection of experts in other fields (combat strategists, fighter pilots, submarine commanders) to help us develop the most realistic strategy/action simulations ever seen.

"ActionSoft puts you at the center of the action. We take you from the depths of the Pacific ocean to the infinite frontiers of space. And with the incredible 3D graphics/animation technology provided by SubLOGIC, our products draw you into the simulation like never before. Up to now this type of realism has been available only on the most expensive military simulators. We're making it available to everyone.

"Our first product is Up Periscope!, a WWII fleet class submarine simulator for Commodore 64/128 and Apple II computers. Up Periscope! is available for the suggested retail price of $29.95.

"Next up is ThunderChopper, a high-performance scout/rescue/attack helicopter simulator. ThunderChopper is also available for the C64/128 and Apple II computers for $29.95."

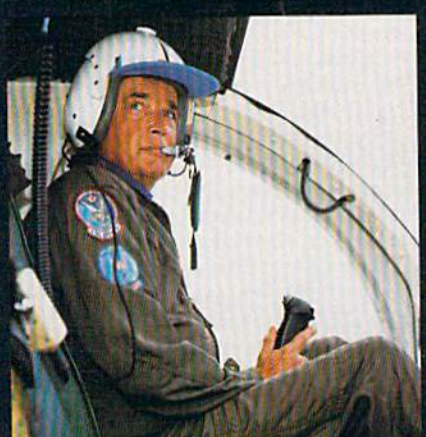
Colonel Jack Declares War on Inflated Software Prices

"My motto has always been 'Better Quality at a Better Price'. ActionSoft simulations are generations ahead in strategy, action, and technology. And at $29.95, they're also priced less than the competition.

"Why pay more for a second-rate simulation when you can have the best for less? ActionSoft simulation software sets the new price/performance standard against which all other simulations must now be judged. But don't just take my word for it. Try ActionSoft - you'll be convinced."

Colonel Jack Rosenow, USAF (Ret)

Captain John Patten's years of US Navy experience provide the realism and submarine combat strategy of Up Periscope!



Colonel Jack's 9000-plus hours of flight time are put to good use in the development of Thunder-Chopper!

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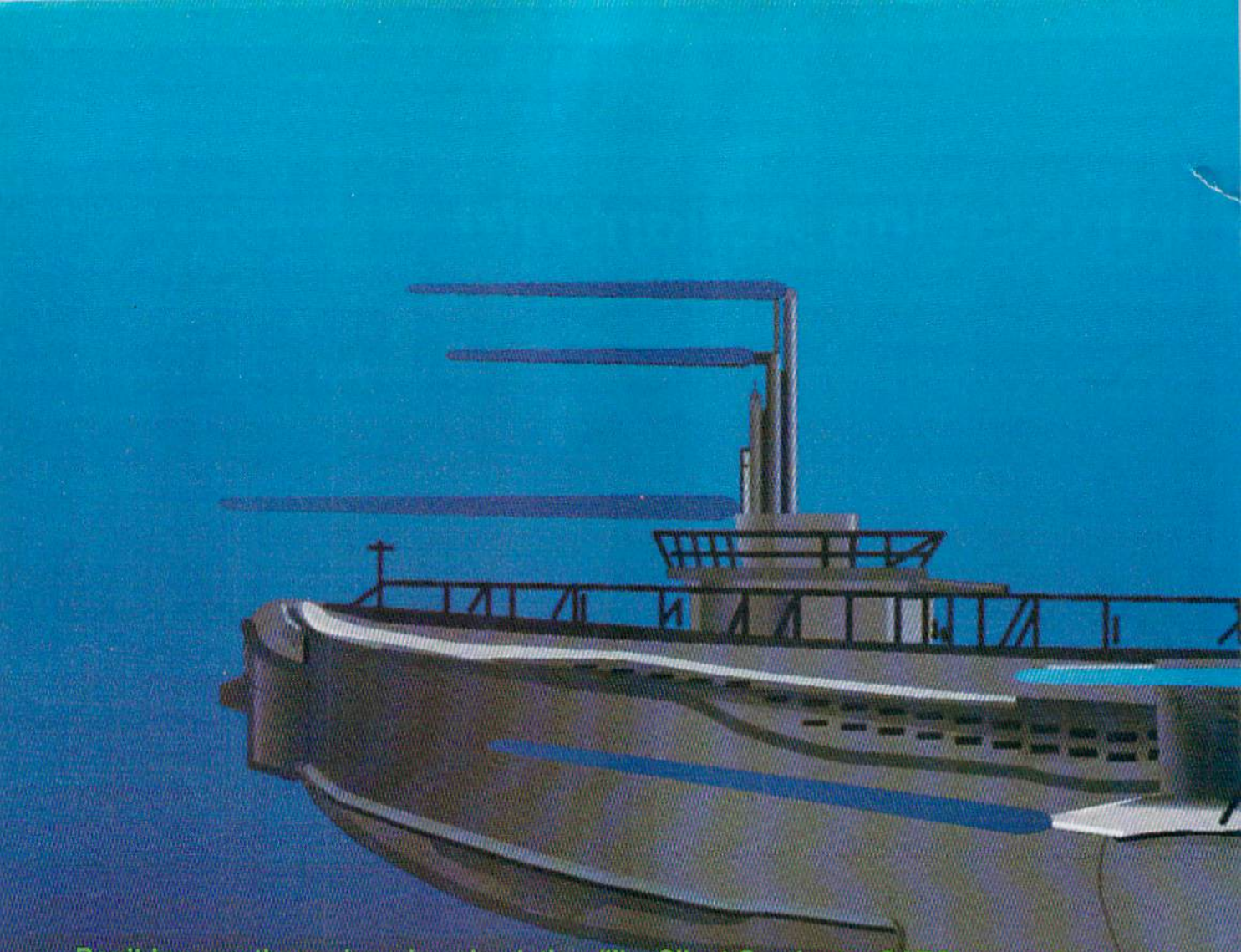


Don't buy another submarine simulation (like Silent Service or GATO) assuming that it comes close to Up Periscope! We think you'll find that the superior strategic play action and 3D animated graphics of this simulation put it generations ahead of the pack!

Strategy

You command a WWII fleet class submarine. Patrol the Atlantic and Pacific theatres of war. Take your orders from COMSUBPAC (Commander Submarine Force Pacific), or go hunting on your own.

Captain John Patten's years of US Navy service provide the submarine combat strategy missing from other sub simulations. Successful enemy engagements are conducted in four separate phases:

1. Contact (Determine direction of target motion)
2. Approach (Close to within effective weapons range)
3. Attack (Obtain optimum firing position & avoid detection)
4. Withdraw (Avoid enemy destroyers & aircraft)

Relive eight different historical situations and compare your strategies with those of real submarine commanders. When you master the daytime periscope-depth attack, move on to the dangerous and skill-demanding night surface patrol.

Up Periscope! includes extensive realistic equipment; surface and attack radars, variable-power periscope, torpedo data computer, and much more. Armament supplies include everything from a selection of old reliable Mark 10s to advanced wakeless (but unproven) Mark 18 torpedoes that can be fired from both fore and aft torpedo tubes.

Graphics and Animation

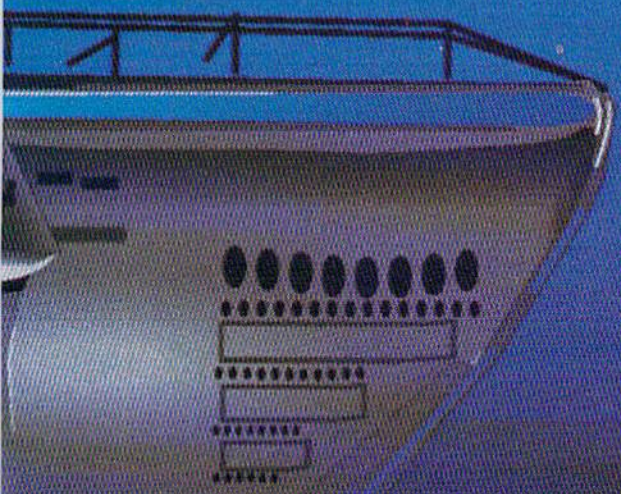
Allied and enemy ships are depicted in truly unprecedented 3D detail, courtesy of SubLOGIC graphics and animation technology. Potential targets include enemy freighters, tankers, troop ships, destroyers, and battleships, plus various friendly forces. A complete instrument panel and split-screen views let you scan all vital information at a glance during the heat of battle.

All major land masses and islands (and even a few minor ones) are properly located. Use detailed Pacific and Atlantic charts to plot your course and navigate right to the action. But be careful not to get rammed or depth-charged by enemy ships. And try to avoid the embarrassment of sinking one of your own Allied ships or running aground on an uncharted Pacific atoll.

For true submarine action and realism, nothing else compares with Up Periscope!

Up Periscope!

Simulation animation and 3D graphic technologies licensed from SubLOGIC



See Your Dealer...
Or write or call us for more information. Up Periscope! is available on disk for the Commodore 64/128 and Apple II computers for a suggested retail price of $29.95. For direct orders please specify which computer version you want. Include $2.00 for shipping and specify UPS or first class mail delivery. Visa, MasterCard, American Express, and Diners Club cards accepted.

Captain John Patten, USN (Ret)

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capability, and is the easiest for our design teams to work with in development," says Tom Frisina, president of Accolade Software, a relatively young software company that's produced a variety of popular 64 game titles over the past year and a half.

"We've all recognized that the 64 still offers a degree of realism and perceived sophistication that can really impress end users who are buying new software for their existing 64s, or buying new Commodore machines," he adds.

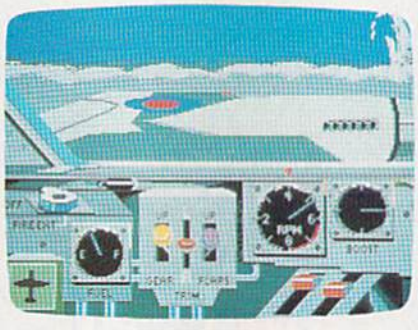
Electronic Arts, a longtime leader in entertainment software, is one of the companies offering a number of new 64 packages this year. And Bing Gordon, EA's vice president of sales and marketing, agrees that the 64 is a terrific game machine. "The Commodore 64 is the IBM of home computing; no one thinks you're dumb if you buy it. And Commodore is the only manufacturer that doesn't mind saying that games are an OK thing."

With strong sales of the new 64C computer, and continued popularity of the Commodore 128 computer, many of the software companies supporting the 64 are predicting a period of extended software support. And that support is strongest in the area of games.

"We're selling to a very large base of Commodore 64s out there, and it's a base that's traditionally very active in game software," says Robert Botch, vice president of marketing for Epyx, a software company that's given longtime support to the 64 and that currently has some 25 Commodore titles available.

"We're betting on the fact that even if Commodore stopped selling the 64 this Christmas, we'd still have a good 12 months. After the first 12 months, you'd see companies like Epyx bringing out less, but not going away from the 64—maybe bringing out about half as many titles.

> *"Programmers have learned the 64 inside and out, and are creating sound and graphics effects that the computer's designers would never have dreamed possible."*



One of the views from the cockpit in Accolade's Ace of Aces, *an aerial combat game.*

Chessmaster 2000 *for the 64 offers both 3-D and 2-D screens.*

"It [continued software support of the 64] could be as long as three or maybe four more years," he says. "An awful lot depends on the consumers."

The following titles are among the newest Commodore 64 games, many of which demonstrate the latest techniques exploiting the machine's graphics and sound capabilities.

Ace of Aces (Accolade)—As the pilot of an RAF Mosquito during World War II, you're battling enemy fighters, bombers, V-1 rockets, German U-boats, and more in a game that showcases the 64's graphics and sound effects.

Amnesia (Electronic Arts)—This is a huge all-text adventure, written by science-fiction author Thomas M. Disch. More than 4000 locations in Manhattan, including the city's subway system, are a part of your search to regain your identity and find out why people are out to get you.

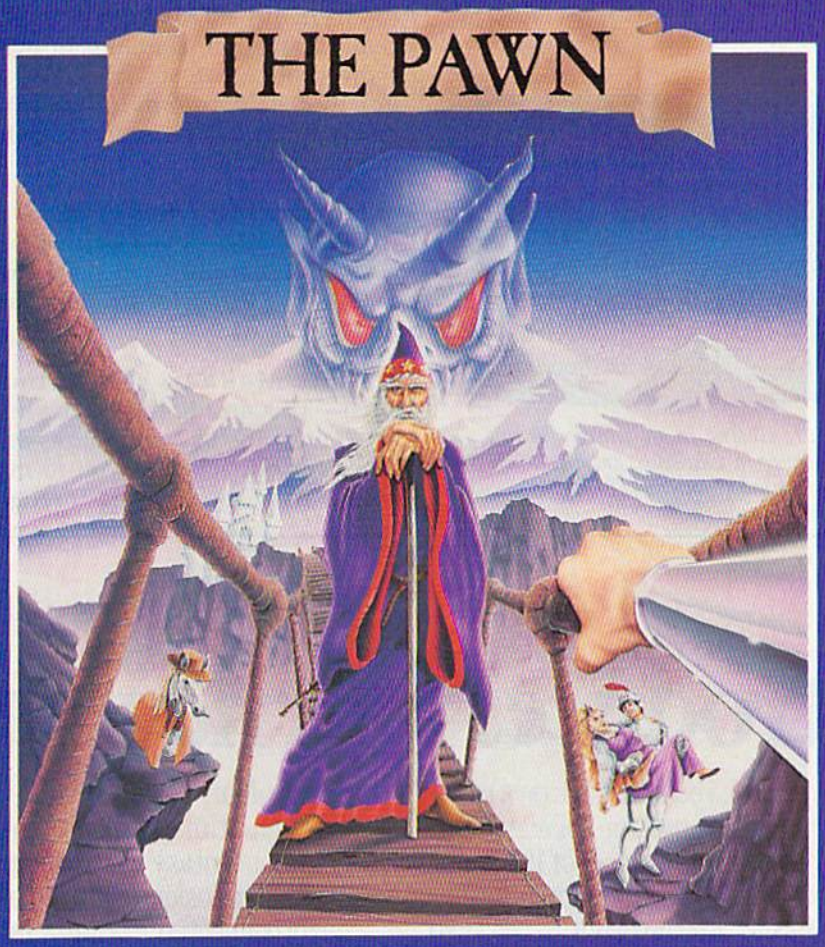
Arch-Mage's Tale: Bard's Tale II (Electronic Arts)—This sequel to the fantasy role-playing game, *The Bard's Tale*, offers an even bigger playing environment, including seven different cities to explore and many new spells and characters.

Battlefront (Strategic Studies Group/Electronic Arts)—This recreation of four different land battles of World War II also includes a design kit to let you customize your own games.

Breakers (Brøderbund)—A 1500-word vocabulary is a part of this science-fiction text adventure and makes it possible for the program to interpret the ordinary English sentences you type in. It's also a *real-time* game, meaning that characters move about and situations change even when you're doing nothing.

Chessmaster 2000 (Software Country/Electronic Arts)—A powerful chess competition program, this

A rare species of interactive illustrated fiction for the Commodore 64™/128™, Amiga™ and Atari 520st™



AUTHORS

Commodore version available April 1986

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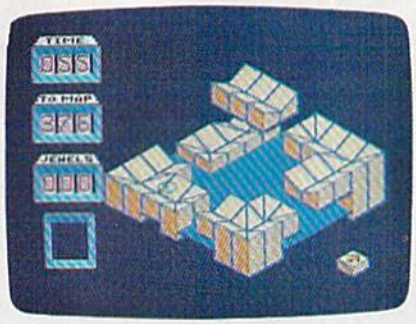
game offers a variety of levels, two- and three-dimensional boards, and a host of other features.

Deceptor (Accolade)—Six levels of mazes keep you occupied as you maneuver and alter your robotic vehicle from screen to screen in this fast-action game. You can even set the game to react to your own level of responses.

Destroyer Escort (MicroProse)—Historical accuracy and realistic details are a part of this World War II simulation of convoy escort duties in the North Atlantic. Ship speeds, weapons, damage assessments, and tactics are all a part of game play.

Electric Dreams Series (Activision)—The first three games in this new series, all previously top hits in the British software market, include *The Rocky Horror Picture Show*, a fast-action game based on the popular movie; *Spindizzy*, a colorful action game with 386 different screens for you to conquer; and *Zoids*, an action-adventure game based on the popular Tomy television and toy characters.



Activision's Spindizzy *offers almost 400 different screens to navigate as you try to map an unknown world.*

You're closing in on a target in this screen from Gunship, *an attack-helicopter simulation from MicroProse.*

Fairlight (Mindscape)—It's up to you to restore the magic in the land of Fairlight in this adventure that also features three-dimensional graphics.

Gunship (MicroProse)—You're at the controls of an AH-64A Apache attack helicopter, with everything from zoom television gun sights and laser range finders to rocket pods and laser missiles.

Hacker II: The Doomsday Papers (Activision)—This sequel to the popular original, contains an even more challenging scenario. You've got to break the Soviet Union's computer security system in order to save the U.S.

Marauder (Mastertronic)—One of the latest low-cost games from Mastertronic, a British publisher that offers a variety of arcade-action hits for the 64.

Marble Madness (Electronic Arts)—This arcade hit is now in a version for the 64, with mazes and a host of obstacles for you to maneuver over, around, and through.

Infocom introduces four new gam

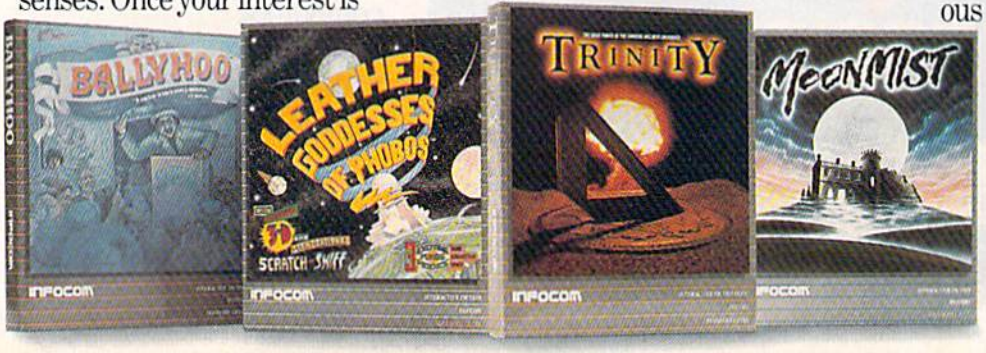
Infocom,™ the crazy people who brought you "Zork"® and "The Hitchhiker's Guide to the Galaxy,"™ has a habit of coming up with games that add a new dimension to interactive fiction. And the best keeps getting better. Case in point: "Leather Goddesses of Phobos."™ It has a scratch n' sniff card and a 3-d comic book to excite all your senses. Once your interest is piqued, you'll embark on a rowdy romp through the solar system. This hilarious spoof of 1930's pulp science fiction has 3 "naughtiness levels," for the prude to the lewd. "Leather Goddesses" is sure to amuse members of either sex.

One's really warped.

Then there's "Trinity."™ It answers the question of whether a game can be both light-hearted and profound. You journey through a time warp into a mischievous fantasy world where all atomic explosions are mysteriously connected. "Trinity" takes you back to the dawn of the atomic age and puts the course of history in your hands.

One's a real circus.

It has been said that the circus is the only really mysterious thing left in civilization. One thing's for sure, there is plenty of mystery in "Ballyhoo."™ While trying to locate the circus owner's kidnapped daughter, you are somersaulted into a three-ring world of deception and crime. To solve the crime



Moonmist (Infocom/Activision)—Infocom's reputation in the all-text adventure field is well known, and this new introductory-level game carries on the tradition. You're an amateur sleuth trying to discover a ghost and a hidden treasure in Tresyllian Castle.

The Movie Monster Game *from Epyx turns you into a real monster.*

The Movie Monster Game (Epyx)—As one of several different movie monsters, you can cause mayhem and hysteria in the world's most famous cities, just by breathing and walking around. The game features colorful graphics, sound effects, and a funny scenario.

Murder Party (Electronic Arts)—You're the host of a murder party, trying to determine who did what to whom. Up to seven people can play, and the game generates all of the clues and culprits, which change from game to game.

Ogre (Electronic Arts)—A Commodore 64 version of the popular board game, *Ogre*, this program pits a supertank against conventional armed forces. You can take either side, and there are ten different playing fields.

Pure-Stat Baseball (SubLOGIC)—Baseball fans will have plenty to work with in this statistical simulation for one or two players. Any team from the 1985 season, plus eight classic teams from the past, can be used. You can also build your own teams and play in one of three different stadiums. A separate stadium disk is also available that features every major league ball park.

Robot Rascals (Electronic Arts)—From two to four players can take part in this robotic scavenger hunt that's half board game and half computer game. The program was developed by Ozark Softscape, the group that created the popular *M.U.L.E.*, *Seven Cities of Gold*, and *Heart of Africa*.

Electronic Arts' new Robot Rascals *is a Commodore 64 scavenger hunt game for two to four players, from the creators of* Seven Cities of Gold.

The Scoop (Telarium/Spinnaker)—This Commodore 128 game is a graphics and text adventure that's based on an Agatha Christie story. As a newspaper reporter, you attempt to solve the murder and get the scoop.

Spitfire 40 (Avalon Hill)—This is an aerial-combat game and a flight

es. One really smells.

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and save your hide from a permanent spot in the freak show, you'll need to stretch your puzzle-solving skills to the limit.

One's really haunting.

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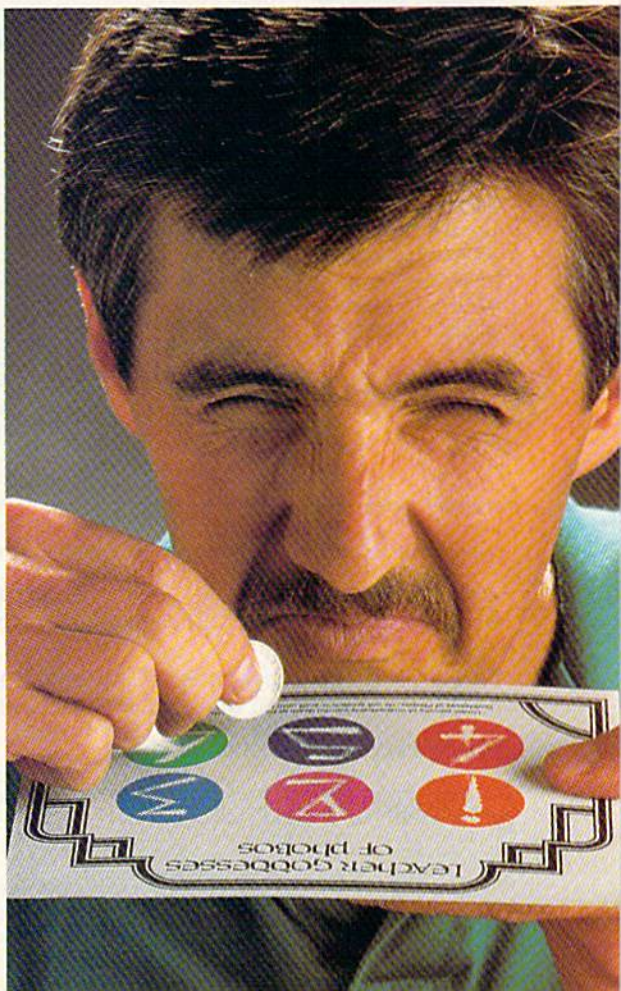

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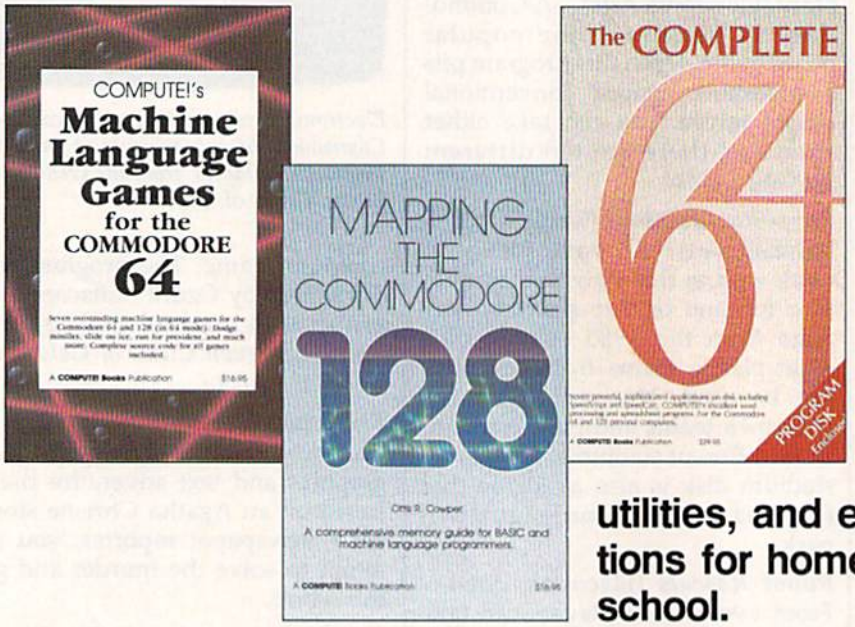
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simulator that puts you in the pilot's seat of a Mark I Supermarine Spitfire during World War II.

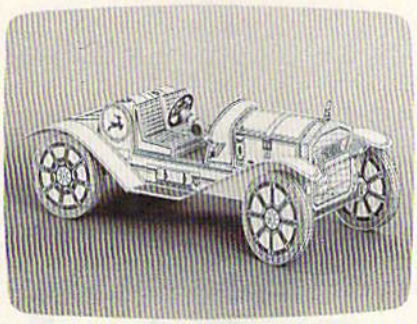
Spy Vs. Spy III: Arctic Antics (First Star)—Detailed color graphics and a clever scenario continue in the latest version of this popular Spy Vs. Spy series based on the *MAD Magazine* cartoon strip.

Starglider (Firebird)—Defend yourself from an invading alien army in this action game that features air-to-air and air-to-ground combat.

Tass Times in Tonetown (Activision)—A strange journey through an alternate universe, this game mixes a humorous and bizarre plot line with excellent graphics and game play.

10th Frame (Access)—From the developers of the *Leader Board* golf simulator for the 64, this is a similar effort featuring the sport of bowling.

The Toy Shop (Brøderbund)—You can build your own customized mechanical toys with this combination computer program and construction kit. Each of the 20 toys included can be made to work, and everything you need is in the kit.

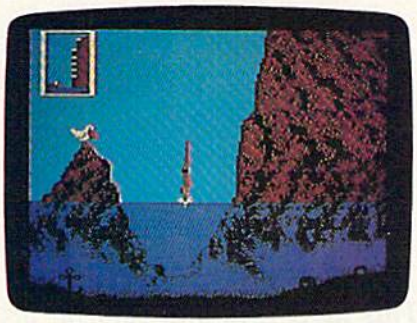


Brøderbund's The Toy Shop *helps you create customized working models of such toys as this 1911 Mercer Raceabout.*

Tracker (Firebird)—You're in command of the TRAC force as you use both strategy and fast-action responses to battle hostile computer-controlled Cycloid fighters.

Transformers: Battle to Save the Earth (Activision)—The popular television and toy Transformer robots are the subject of this action game. The flip side of the game disk contains a visual and verbal history of the Transformer characters that's told through speech synthesis on the 64.

Trinity (Infocom/Activision)—This standard-level text adventure mixes magic and physics, sending you to different time periods and locales around the world as you attempt to change the course of atomic history.



The cliff-diving event in Epyx' World Games *is just one of eight different action contests within this game.*

World Games (Epyx)—Attention to detail and superior color graphics are a part of this fast-action sports simulation that's the latest in a series of such games from Epyx. Eight new athletic events are included, and each sport takes place in a different country.

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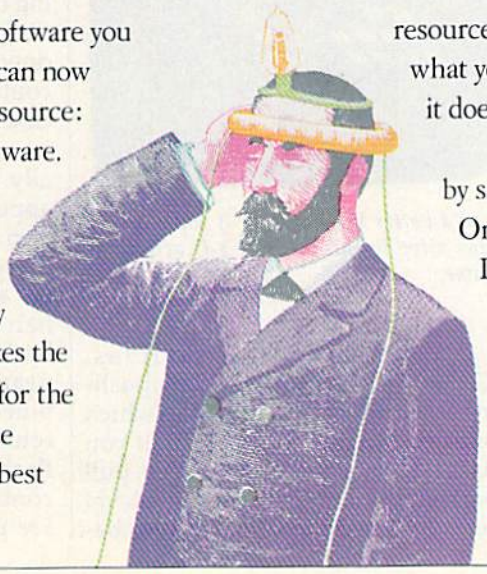

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Q-Bird

Mike Sedore

This delightful and colorful arcade-style game for the Commodore 64 challenges your character, a defenseless (but nimble) baby bluebird, to survive among a crew of nasty, hungry enemies. A joystick is required.

Other birds say you're paranoid, but you're not—everyone really *is* out to get you. You often ask yourself how long a defenseless baby bluebird can hope to survive when a host of voracious predators are looking for a meal. If only you could leave this place to find a new home. But alas—you're too young to fly. The best you can manage is a flapping long jump. But you'd better be careful not to jump too far: You could fall a long way down.

Typing It In

Since "Q-Bird" is written entirely in machine language, you'll need to type it in with "MLX," the machine language entry program found elsewhere in this issue. When you run MLX, you'll be prompted for a starting address and an ending address for the data you'll be entering. For Q-Bird, use the following addresses:

Starting address: 0801
Ending address: 19A8

Be sure to save a copy to disk or tape when you've finished typing. Although Q-Bird is written in machine language, it can be loaded and run like a BASIC program. To play, type LOAD "*filename*",8 (for disk) or LOAD "*filename*",1 (for tape). When it's finished loading, type RUN to start the game.

Q-Bird is played on a 6 × 7 grid. There are 15 levels of play from which to choose. As you play, you advance level by level by completing grids. A grid is complete when the color of each square matches the goal color shown at the bottom of the screen. To change the color of a square, simply hop on it. You have to jump on each square once in level 1, twice in level 2, and so on up to level 15. A bonus life is awarded each time you complete a level. If you reach level 15, you should feel satisfied. It doesn't get any harder than this. But don't relax; it doesn't get any easier either.

You'd better keep moving if you want to stay alive in this colorful 3-D action game.

You start with five lives. Choose your starting level by pushing forward on the joystick (which must be plugged into port 2). If you pass the level you want to play, pull back on the stick to reverse the level counter. Press the fire button to begin play. To hop, simply move the joystick in the direction you want to go. For a super jump, push the fire button as you hop: You'll leap over a square and land on the next. If you time it right, you can leap right over your enemies. But be careful not to jump over the side of the grid. That costs one life.

Press SHIFT–LOCK to pause the game. To restart a game, press RUN/STOP–RESTORE.

Leapin' Lizards

Three purple lizards live on the grid. They randomly leap off of their tails from square to square, landing on any bluebirds careless enough to get in their way. But they're the least of your worries. There's a king cobra that relentlessly chases you. He's got a hole in his stomach just the size of a baby bluebird. If he doesn't get you, then perhaps the low-flying and hungry hawk will. And while you're looking out for all of these villains, try to dodge the runaway balls that roll down the grid. Any one of them could turn you into a bluebird pancake in a moment.

Fortunately, you do have an ally. Occasionally, a flashing egg appears on a random square. If you hop on it, you momentarily stun all the grid inhabitants. You can now go anywhere you please without harm. Unfortunately, this doesn't last long. When the safe time is nearly through, your character, the bluebird, begins flashing. All action returns to normal after the third flash, so be ready for the frenzy to continue.

See program listing on page 132.

VISIT EXOTIC LANDS AND WIN OVER THE NATIVES.

There is a place, probably a long, long way from where you're sitting right now, where grown men actually wear dresses and throw telephone poles in the air as a sign of athletic prowess.

It is true.

There is another rather bizarre land where grown men actually throw *themselves* in the air as a sign of athletic prowess.

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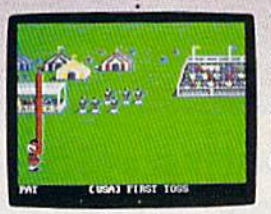

Anyone who can throw a telephone pole long distance is entitled to wear a dress.

You haven't lived until you've taken a log out for a spin.

Try Canada's ridiculously difficult log roll. Or ski the brutal, wintry slopes of France.

Then it's back to the good old US of A to ride a bucking bull. And off again to bully Moscow with some heavy-duty weight lifting.

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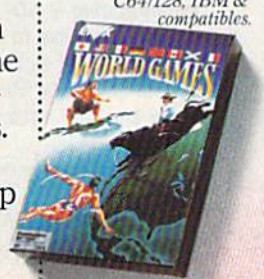

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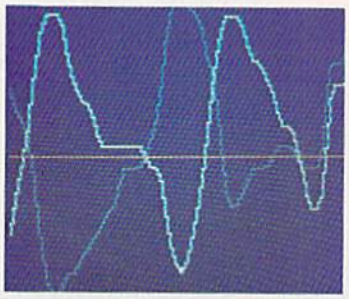

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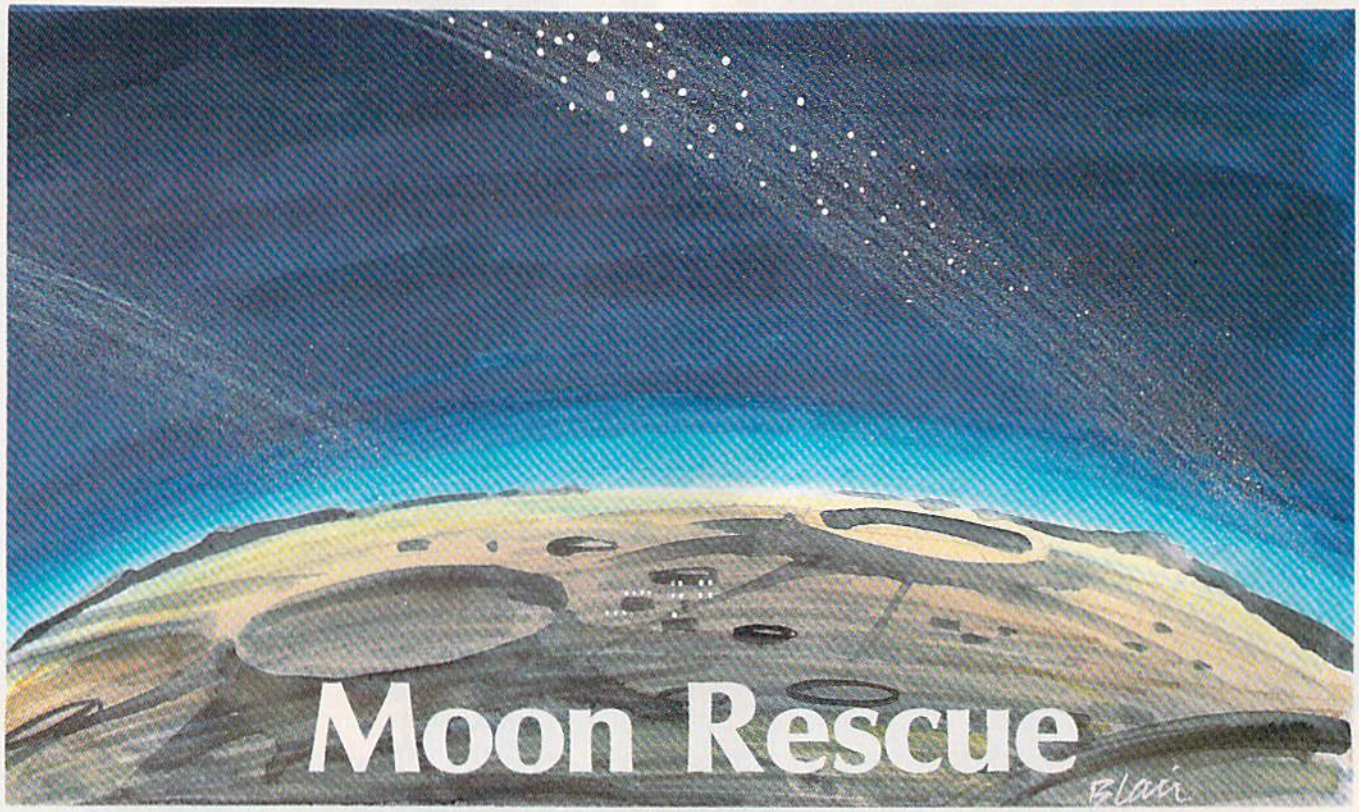

Edward E. Boughton

Your mission in this colorful, arcade-style game is to rescue a stranded space colony of scientists. For the Commodore 128. A joystick is required.

You awaken to an alert siren. When you open your eyes, you're disoriented. Your watch says it's 3:51 a.m. "What's going on?" you mutter. Then the announcement blares through the barracks and you remember who you are—a member of the Space Rescue Team. "Attention! Emergency Code Two." You leap from your bed and dress—"neat and fast"—the same way you were trained to do everything. You know you'll be expected in the briefing room in one and a half minutes.

You pilot a remote-control spaceship, a Small Robot Lander, but you call your ship what all the other pilots call it—the SRL. As the pilot of a robot ship, you have an awesome responsibility—although you can never die, your passengers can. Today's emergency mission is to rescue a colony of scientists that's working on a moon under bombardment by an asteroid belt. "Those men should have been evacuated," you growl. "They would have been," says your project leader, "but they said they were onto something really big. You know how hard it is to argue with the scientists."

Your mission in this game is to guide your Robot Lander through the dangerous asteroid belt and rescue a team of scientists. Note that the player has just picked up one scientist and is taking him back to safety.

You begin with three SRLs, and will be assigned an extra one each time you rescue four scientists.

The Mission

Type in and save a copy of "Moon Rescue." To play, load it and type RUN. You're first asked if you wish to "Make New Rocks (Y/N)." Press Y. This sets up the screen and sprite data. This has to be done only at the beginning of a playing session. After your first game, answer N to skip this initialization.

The game begins with your first SRL docked at the top of the screen. There are four belts of asteroids between you and the scientists. Pull the joystick toward you to begin your descent. Your ship is highly maneuverable. You can move in eight directions through joystick control. When you near a scientist, carefully land your ship on the white docking pad. After a few seconds, the grateful—if somewhat distracted—scientist will climb on board. An SRL can hold only one passenger, so you must return to the docking port at the top of the screen before picking up another scientist.

At the top of the screen is a status line which keeps track of the number of scientists saved, the number lost, the number of sets (four per set) of scientists saved, and the number of SRLs left. But as a dedicated rescue team member, you know that there's no real score when it comes to saving lives—only the satisfaction of a job done right.

See program listing on page 129.

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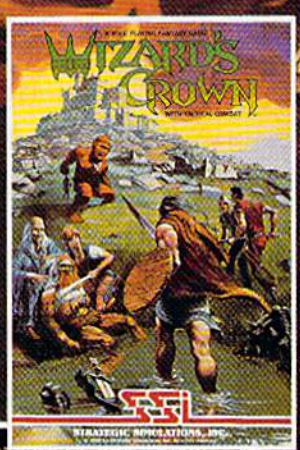

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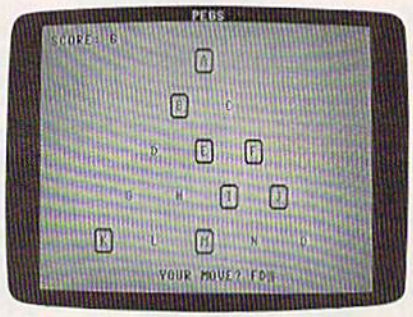
Pegs

Jim and Deborah Chambers

This familiar puzzle takes on a new twist when you play it on your computer. Versions for the Commodore 64, Plus/4 or 16, and VIC (with 8K or 16K RAM expansion).

"Pegs" is a game that has been around for decades. High school shop students and Junior Achievement clubs have produced millions of the little wooden triangles with golf tees for pegs. We've written a computer version of the game which has two advantages over the traditional version. First, you can't misplace any of the pegs, and second, we've added a "take-back" function that allows you to go back as many moves as you like at any time.

The object of Pegs is to leave only 1 of the 14 pegs on the board after a series of jumps. If you leave more than one peg stranded, your score will be lower than the perfect score of 13. Play the game by jumping one peg over another to an empty hole. The peg that was jumped is removed. Repeat this until you can't make any more jumps. The computer will know when you've reached this point and display a final score. It will then ask if you'd like to play again or back up. Type N to return to BASIC, Y to play again, or the back-arrow key (←) to go back one move at a time. Press RETURN after each of these selections.



This traditional game offers a few new twists. In this round, the player has chosen the move FD, which will move the peg at F to D, causing E to be removed from the board.

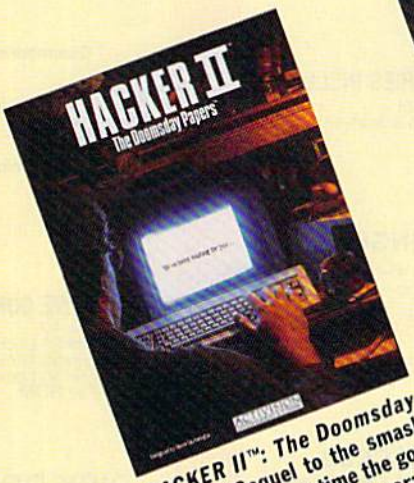
After typing in the version for your computer (Program 1 for the 64, Program 2 for the VIC-20, or Program 3 for the Plus/4 or 16), save a copy to tape or disk. Note that the VIC-20 version requires an 8K or 16K RAM expander. To play, just load the program and type RUN.

Make your move by typing in a two-letter command representing the position you're moving from and the position you're moving to. For example, type DA or FA (the only possible opening moves, incidentally). Press RETURN after you've typed your move. If you find yourself in a hopeless situation, press ← (the back-arrow key in the upper left corner of the keyboard) as many times as necessary to step back through your previous moves.

There are several solutions to the puzzle. If you don't succeed the first time or two, try again.

See program listings on page 130.

SIX GREAT NAMES IN COMPUTER GAMES



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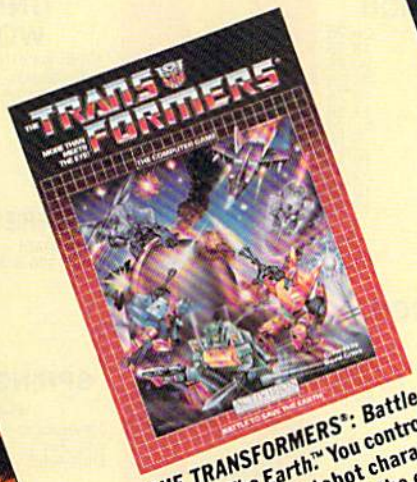

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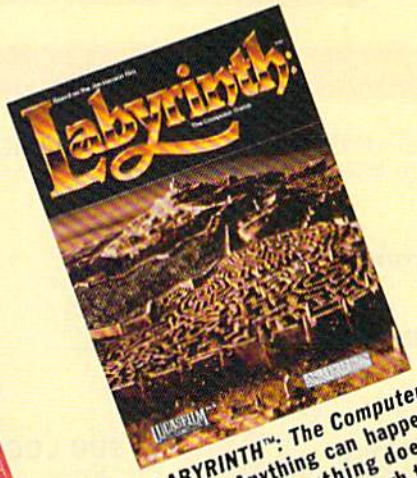

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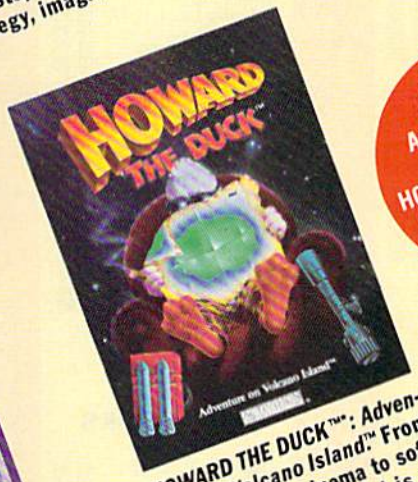

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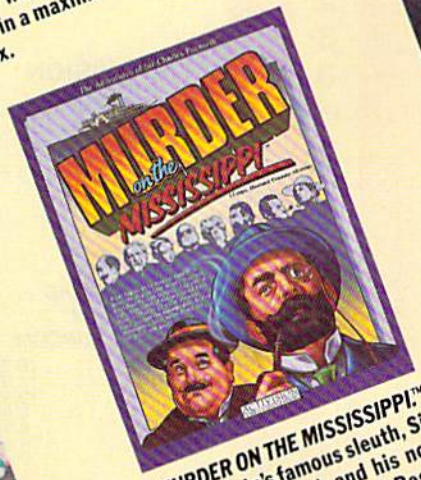

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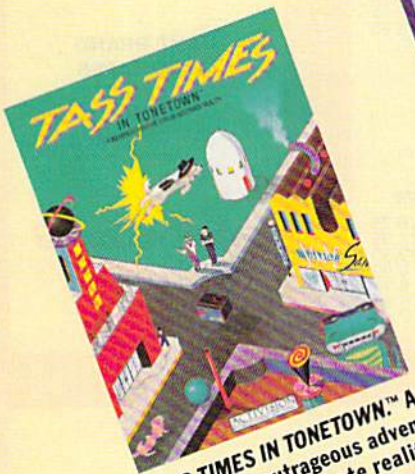

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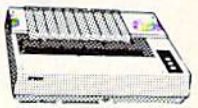

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The Animals' Show

Cullen O'Day

This is one of the most enchanting and fun programs we've seen. Both children and adults will enjoy creating and saving songs performed by various octets of musical animals. For the Commodore 128. A disk drive is required.

It's the night of the animals' show. The audience has been seated; the house lights are down; the players have warmed up—it's showtime!

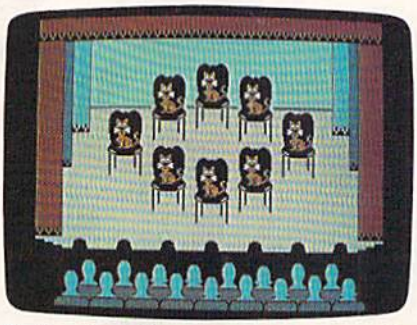
"The Animals' Show" is a creative and playful music game geared to children at two age levels. Younger children can use a joystick to play intuitively. Older children (and adults) will prefer to compose with the 128's numeric keypad. In either case, kids can play for as long as they like. When they finish, they have their own original songs to show off to parents and friends.

Strike Up The Band

After typing in the program, be sure to save a copy. (Pay particular attention to typing in lines 130–170.) To get started, load the program and type RUN. You'll be prompted to select either the joystick (in port 2) or the numeric keypad as an input device. The title screen is displayed while the program reads the sprite and character data.

Next, the menu screen is displayed. Arranged in a circle are eight available options: the five different types of animals, disk functions, replay function, and quit option. If you're running the program for the first time, select one of the animals. Whenever you choose an animal from the main menu, you'll write a new song. If you're using a joystick, simply push it in the direction of your selection. If you're using the keypad, the positions of the keys within the keypad arrangement correspond to the positions of the menu selections: 1 = disk functions, 2 = quit, 3 = replay, 4 = frogs, 6 = parrots, 7 = pigs, 8 = cats, and 9 = mice (the 5 key serves no function). Each animal has a unique pitch and vocal range. To register your selection, press the joystick fire button or the ENTER key.

The main menu lets you select a performance from any of five kinds of animals—as well as other disk and program functions. The cat is being selected as the performer of the next song.



Eight cats perform your song as a captivated audience looks on. You can store your song on disk for a future performance.

The menu screen is then replaced by the stage and audience. Press the fire button or the ENTER key to open the curtain. After the applause has died down, move the joystick or push the keypad keys for the animals' performance. The lowest note is made by pressing forward on the joystick or by pressing 8 on the keypad. Notes get higher as you progress clockwise. Thus, to play an ascending scale, type 8 9 1 2 3 4 5 6 7. Keypad users can use the 0 key to insert rests into the song—there is no joystick equivalent for rests.

When your composition is completed, press the fire button or the ENTER key. The audience will applaud your composition and the animals' performance. After the curtain closes, the program will return to the menu.

Now choose the replay option and press the fire button or the ENTER key. An animal menu will appear. Select an animal; then press the fire button or the ENTER key. Sit back and watch as the stage appears and the curtain opens automatically. Eight animals of the kind you selected will sing your most recently created song. The audience will applaud and the curtain will close.

Saving Your Song

Select the disk option when the menu appears. The program asks if you want to save or load a song. Press S. At the next prompt, type in a title for your song and press RETURN. The disk drive will spin for a few seconds and the menu screen will return.

Whenever you want to hear your song, select the disk option and press L at the Save or Load prompt. Then type the song's name, press RETURN, and the song will be loaded. The animal menu will then appear just as it does in the replay option. Make your choice and listen once again to your masterpiece.

If you find that the program won't let you write long enough songs (it currently allows 200 notes, including rests), raise the value of the variable SE in line 190.

See program listing on page 134.

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Send typed additions, corrections, and deletions for this list to:

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User Group Notes

You can reach the **LIVICS Commodore Users Group** at 15 Hastings Dr., Stony Brook, NY 11790.

Mohawk Valley Computer Users Group has changed its address to R.D. #2, Box 177, Johnstown, NY 12095.

Lowerbucks Users Group has a new address: P.O. Box 548, Feasterville, PA 19047

The new address for the **Central Dakota Commodore Club** is 12 Captain Leech Dr., Mandan, ND 58554

New Listings

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The Commodore Connection, P.O. Box 1003, Birmingham, AL 35126

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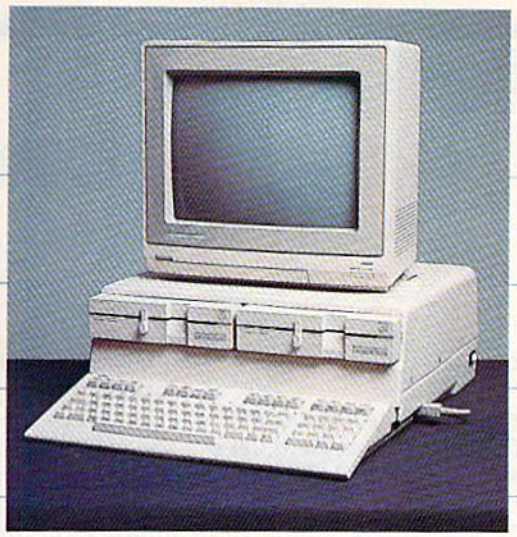

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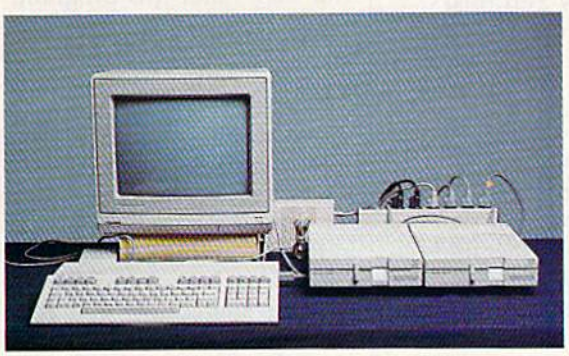

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PRINT And INPUT

Larry Cotton

Before we get back to experimenting with the PRINT statement, let's take a brief look at the NEW command. When you type NEW and press RETURN, you're telling the computer, "Erase this program and reset your memory for another one." Without this command, you'd have to turn off the computer to start working on a new program.

NEW should be typed only when you're *sure* you want to erase the program in memory. If you're not sure, but you still want to start a new program, just save the old one to tape or disk.

I also promised last month that we'd clear up a few aspects of the PRINT statement which were left hanging. The first concerns the way things are arranged on the screen. This depends on how PRINT statements are punctuated.

Punctuating PRINT

There are four ways to punctuate the end of a PRINT statement—with a comma, semicolon, a colon, or with no punctuation at all. First let's start with no punctuation. Type this:

```
10 PRINT"ABCDEFGHI"
20 PRINT"ABCDEFGHI"
30 PRINT"ABCDEFGHI"
40 PRINT"ABCDEFGHI"
```

There are nine letters in each string. Run this program and observe the results. Next, add a comma right after the second quotation mark in all lines.

When you run it now, the letters are arranged on the screen in columns. The comma at the end of each line tells the computer to arrange whatever is in quotes into four columns of 10 characters each (except for the VIC-20, which will arrange the text into 11-character columns).

The computer insists on putting at least one space between columns. Thus, if there were ten characters inside the quotes (go ahead—try it), the computer would push the information over into the next column. Also try changing the information in the quotes to seven or eight characters.

Changing the comma to a semicolon yields entirely different results. The messages are printed continuously without spaces.

Let's assign some string variables and print them. Type NEW, then this:

```
10 A$="STRING"
20 B$="VARIABLE"
30 PRINT A$,B$
40 PRINT A$;B$
50 PRINT A$B$
```

When you run this, line 30 breaks the strings into columns, while lines 40 and 50 print them together. In the case of string variables, a semicolon is not required between the variable names to print them continuously.

Now type NEW and this:

```
10 A=1234567
20 B=7654321
30 PRINT A,B
40 PRINT A;B
50 PRINT AB
```

A and B are numeric, not string, variables. They can have a maximum of seven numerals each (eight for the VIC-20) in order to be printed in adjacent columns because Commodore BASIC puts a space (or a negative sign if the number is less than zero) before and a space (for separation) after each printed numeric variable, in addition to the space between columns. Line 30 demonstrates this. Try changing A and B to numbers with four or five numerals.

Even with a semicolon (line 40), two spaces are added between the values for A and B. In line 50, we attempt to print A and B without any punctuation, but the computer interprets AB as another variable entirely. Since its value hasn't been assigned, the computer prints the number 0.

Numeric and string variables can be either one letter, two or more letters, or a combination of a letter and number. Examples of valid variables are D, D$, D4, D4$, DE, DE$, DEVO, and DEVO$.

The number can't come first in a variable—4D and 4D$ don't work. And if you use more than two characters, the computer sees only the first two. Thus DE, DEVO, and DEVICE are all the same to the computer.

On To INPUT

We'll continue to use PRINT in our short BASIC programs, but for now, let's concentrate on a BASIC statement which can be even more fun to use—INPUT.

INPUT is fun to use because it requires the intervention of a human in order to work. Type NEW and then enter this program:

```
10 PRINT"{CLR}"
20 INPUT A$
30 PRINT A$
```

Now run it. Line 10 clears the screen and sends the cursor home. Line 20 causes the computer to wait for the user to type something, as indicated by the incessantly blinking cursor. It's waiting for the user to type something that the computer will define as a string—A$.

The string can consist of almost anything that's printable—letters, symbols, most punctuation, even numbers, although they're treated just like a string of letters; you can't perform any math operations on them.

INPUT also requires one more thing before it moves on, and that's a RETURN. After you press RETURN, line 30 prints the message just like you typed it.

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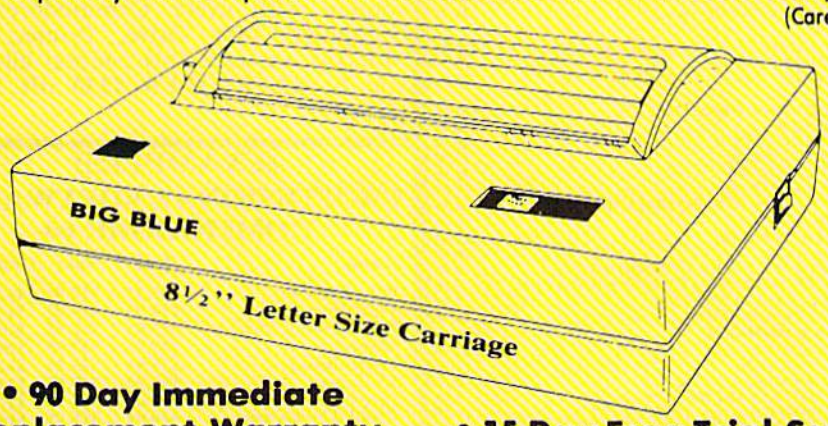

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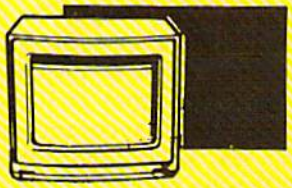

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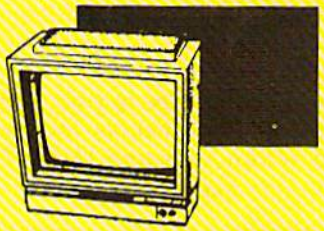

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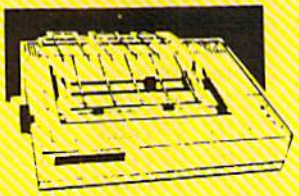

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in your INPUT message, the computer sends out a message of its own—?EXTRA IGNORED—after the offending character.

You're probably thinking, "Big deal. I type in a message and the computer prints it right out. What's this useful for?"

Not much, superficially. But remember—we have assigned a string variable, A$. In the immediate mode—that is, now, without a line number—type PRINT A$ and press RETURN. Bingo! Your message is printed again. Any time you want your message displayed on the screen, whether in immediate mode or within a program, just type PRINT A$. To see another use for INPUT, type NEW, then this two-line program:

```
10 INPUT"WHAT'S YOUR NAME";
   A$
20 PRINT"HI, "A$
```

Suddenly the computer gets smart. INPUT features the ability to print a message while it waits for the user to type something. Also, INPUT includes a complimentary question mark, as we've seen, so it doesn't have to be in your message. Remember to include the semicolon when you use INPUT like this—it's mandatory.

```
30 PRINT A$" IS SMART!"
40 PRINT A$" IS FANTASTIC!"
50 PRINT A$" IS TALENTED!"
```

Now run your program.

What INPUT always looks for is a variable. It may appear right after the word INPUT with no punctuation, as INPUTA$, or it may appear after a quotation mark and semicolon, as in line 10 above. The variable may be numeric or string. Add these two lines to the program:

```
60 INPUT"HOW OLD ARE YOU";A
70 PRINT A$" IS"A"YEARS OLD
   !"
```

Look carefully at the general construction of these two lines. When the computer encounters the variable A in line 60, it expects you to type a number instead of a letter (unlike string variables, which don't care). In fact, if you do type a letter and press RETURN, the cryptic message ?REDO FROM START pops up. This is not a syntax error—it is Commodore's inimitable way of telling you that the computer is expecting a number. If you see this message, all you have to do is type a number.

In line 70, IS (with a leading space) and YEARS OLD! are inside quotation marks—they're printed literally. But variables A$ (your name) and A (your age) are outside the quotes; the computer searches its memory for values to spit out when it encounters these variables.

If you have any questions on this very common BASIC construction, study the subtle ways numeric and string variables are handled and the way punctuation is used.

The Elves' List

The INPUT statement may ask for more than one value, in which case they may be numeric, string, or mixed. NEW the program in memory and type in this one:

```
10 PRINT"{CLR}"
20 PRINT"FIVE NICE FRIENDS'
    NAMES"
30 PRINT
40 INPUT A$,B$,C$,D$,E$
50 PRINT
60 PRINT"FIVE NAUGHTY FRIEN
   DS' NAMES"
70 PRINT
80 INPUT F$,G$,H$,I$,J$
90 PRINT"{CLR}"
100 PRINT"NAUGHTY",,"NICE"
110 PRINT
120 PRINT A$,,F$
130 PRINT B$,,G$
140 PRINT C$,,H$
150 PRINT D$,,I$
160 PRINT E$,,J$
```

In keeping with the Christmas spirit, what we have here is an Elves' List, which demonstrates a number of points about PRINT and INPUT.

Line 10 clears the screen and sends the cursor home. The first message is printed in line 20. Line 30 prints a blank line for readability. Line 40 is our first multiple INPUT statement—it waits for the user to type in five strings (A$–E$); press RETURN for each.

Lines 60–80 repeat the format of 20–40, but with a different message and five more string variables, F$–J$. Time to clear the screen and home the cursor again in line 90. Line 100 prints the heading for the complete list.

Note especially the two commas between NAUGHTY and NICE; these put the headings in two columns, but the extra comma puts an extra blank column between the two.

Line 110 prints a blank line after the heading, then lines 120–160 print out the strings. Again, note the two commas between the string variables' names; these make the name lists fall directly under the appropriate heading.

We've covered a lot of semi-tricky ways that INPUT and PRINT can work with each other, as well as with numeric and string variables. The only way to master these is to practice and experiment. Don't be afraid to try things which you don't fully understand. Analyze them and you will.

And Merry Christmas—we'll see you again next month. @

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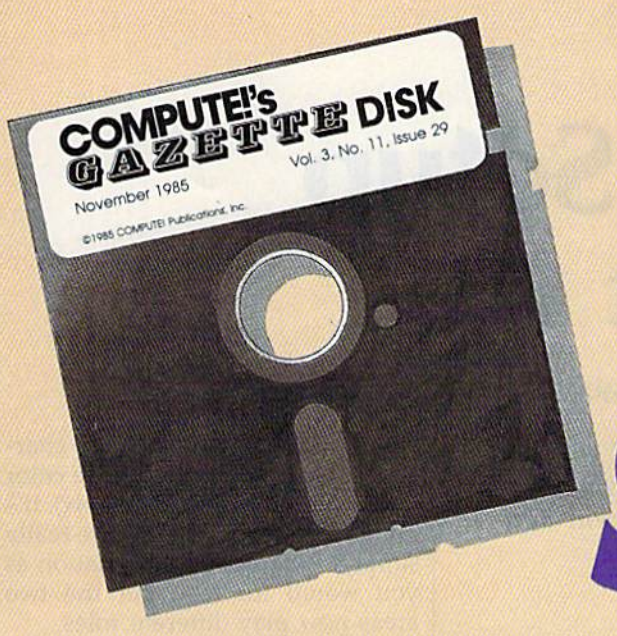

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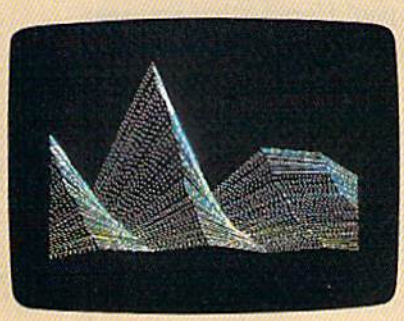

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Video Setup
Part 1

Jim Butterfield, Associate Editor

This program provides you with all the information you need to create a custom screen—with characters or in high resolution—for the Commodore 64. Next month's installment will cover the 128.

When you want to set up a special video screen, the arithmetic can get difficult, and there are pitfalls that may be hard to see. "Video Setup 64" helps you with the screen positioning calculations.

The regular 64 text screen is good enough for many applications. But sometimes you want to make your own character set or do high-resolution work. Or you might be planning dual screens, where you switch from one to another; such an arrangement could be useful for a help screen, for animation, for scrolling by switching from one screen to another, or even for split-screen work.

Video Setup 64 won't do all the work, of course. Character-set and sprite construction is up to you; this program just helps allocate the space you'll need for all the elements of the screen. If you plan to use two screens in a program, you'll need to run Video Setup 64 twice; once for each screen. You'll then have two sets of POKEs to switch in each screen.

Advanced features, such as split-screen work, call for much more programming—and understanding—than Video Setup 64 can give. The program helps you with the arithmetic work, but after that it's up to you.

Running The Program

Before we start experimenting, type in and save a copy of Video Setup 64. Then load it and type RUN. Video Setup 64 first asks what type of screen you'd like to set up. Is it text (characters) or high resolution? If it's text, do you want the standard character set? Your answers affect the questions that follow.

All of the data for your screen—screen memory, character set, and sprites—must reside within a single 16K block of RAM memory. If you want the standard character set, you must choose block 0 or 2—addresses 0–16383 or 32768–49151—since those are the only ones where the character ROM is visible to the video chip. If you don't want standard characters, you may be better off in blocks 1 or 3 (addresses 16384–32767 or 49152–65535) so that the standard character ROM doesn't clutter your available video memory space.

If you're creating a text screen and have decided on a custom character set, you'll be asked to choose a site for it; this area is called the *character base*. Keep in mind that the computer allocates enough space for 256 characters to be defined; if you don't need that many, you don't have to use the entire memory area for character definitions. If you specify that you want the regular character set, the computer knows where to find it.

If you're using a text screen, you'll be asked to pick a location for screen memory, formally called the *video matrix*. You're offered safe addresses—those not used by other video elements.

If you're doing a high-resolution bitmapped screen, you'll be asked for the screen area (the character base or bitmap) and the color memory area (the video matrix). It's interesting to note that you're really supplying the same information as you would for text, but the two areas now play different roles.

That's it. When you press Y to tell the program that you're ready, the computer gives a summary of the areas used and the POKEs needed to create them. Video Setup 64 gives a cautionary note if there's a danger of your screen area conflicting with BASIC (if you've chosen memory area from 53248 to 57343, which is hard to get at; it's possible, but not easy).

Sprite information is also supplied if you choose to see it.

A First Run-Through

Let's look through this program and use it to set up something trivial—the 64's normal screen. At first, this seems silly—we already have this screen. But when we work through the numbers, we'll get the POKEs that will help us to get back to this configuration from any other.

Enter responses as follows: 1 for characters, N for building your own character set. Then select memory area 0 (addresses 0–16383). Finally, choose video matrix 1 (screen memory is normally at locations 1024–2047).

Now get out your pencil and pad. Here's what you see:

```
VIDEO MATRIX: 1024 TO 2047
(SPRITE POINTERS AT 2040 TO 2047)

POKE 56576,7
POKE 53272,20
POKE 648,4
POKE 53265,27
```

Each POKE statement has a small explanation of its purpose.

You should now see the question "Will you want sprites?"

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Answer Y and note that there are three areas in which sprite drawings may be placed.

The program warns you that BASIC normally occupies memory that we might choose to use for sprites; in this case, there's no conflict with the video matrix. You could choose to relocate the BASIC work area; that would involve changing a pointer at addresses 43 and 44 and commanding NEW—but that's outside the scope of Video Setup 64.

We don't need to perform any of these POKEs now, since our 64 is already set to these values, but we'll keep them in mind.

Our First Real Task

Suppose someone with an old PET/CBM machine asked you whether you could adjust the 64's architecture to match their machine. Why might they ask? Perhaps they have some neat PET programs that use screen POKEs, and the screen on the 64 is in a different place. More importantly, if you can match the PET architecture, programs saved from your 64 can be loaded on a PET/CBM. The older machines can't relocate programs, so they must be saved from the same address to which they will be loaded.

First, the video information: 1 for characters, N to build your own character set, memory area 2, and video matrix 0 to put the screen at address 32768. Plug this into Video Setup 64, and we get:

```
VIDEO MATRIX: 32768 TO 33791
(SPRITE POINTERS AT 33784 TO 33791)

POKE 56576,5
POKE 53272,4
POKE 648,128
POKE 53265,27
```

These POKEs move the screen as desired. Note that the last POKE—the one to location 53265—is the same value as for a normal 64 screen, so we really don't have to do that one.

But we're not done yet. On the PET/CBM, the BASIC area goes from 1025 to 32767. Now that we've liberated the screen from area 1024–2047, we can move the start-of-BASIC pointer to align with the PET. We'll do this with:

```
POKE 1024,0:POKE 44,4:NEW (don't do this yet).
```

What about the end of BASIC? On the 64, this goes up to location 40959. But we can't allow this, since our newly positioned screen is in the way (it starts at location 32768, remember?). So we change the end-of-BASIC pointer (addresses 55 and 56) with the command:

```
POKE 55,0:POKE 56,128:CLR
```

Let's put this all together into a simple program to imitate the PET's memory architecture. NEW must be the last command, so we write:

```
10 POKE 56576,5:POKE 53272,4:POKE
   648,128 (from Video Setup 64)
20 POKE 55,0:POKE 56,128:CLR (trim-
   ming end of BASIC)
30 POKE 1024,0:POKE 44,4:NEW (moving
   start of BASIC)
```

Type RUN. Nothing seems to happen, except that the screen gets messy. This happens because we've switched to a new screen memory and haven't cleared away what was there before. To solve the problem, add this line: 15 PRINT CHR$(147), or just clear the screen now.

But something else has happened also. PRINT FRE(0) reveals that we have been trimmed back to 31741 bytes of BASIC memory—matching that of a 32K PET/CBM. POKE 32768,1 puts a letter *A* in the upper left corner of the (newly relocated) screen. If it doesn't, then you have a 64 model which needs an additional POKE to color memory—try POKE 55296,7 to make it turn yellow.

Programs saved from this reconfigured 64 will load on a PET/CBM.

Going Back

How do we return to a normal 64 configuration? We could just switch the machine off and back on, of course. But we'll follow through the same logic with this program:

```
10 POKE 56576,7:POKE 53272,20:POKE
   648,4 (from Video Setup 64)
20 POKE 55,0:POKE 56,160:CLR (resetting
   end of BASIC)
30 POKE 2048,0:POKE 44,8:NEW (moving
   start of BASIC)
```

Type RUN and you'll be back, with a new messy screen.

A Memory Tour

Let's take a quick tour of memory to identify the areas that might be a bit tricky when you're doing video work.

The first 256 locations—0–255—are sensitive and important. The operating system needs this area: Leave it alone.

From 256 to 1023 we have working areas, including the stack, buffers, pointers, and other odds and ends. It might be possible to slip a few sprites in here, but you'll need to be careful and check with a memory map for possible conflicts.

Address range 1024–2047 is where screen memory is normally located. From 2048 up to 40959 we find the area used for BASIC—the BASIC program together with its working values (variables, arrays, and strings). But there's a hitch. The video chip can never see RAM from 4096 to 8191 or from 36864 to 40959. Instead, the character ROM is planted at these video locations. Good if you want standard characters, but not for drawing your own art.

At addresses 40960–49151, the video chip is happy to use the RAM, but BASIC programmers have a special problem. A POKE stores to this RAM, but a PEEK won't see it. That's because ROM (the BASIC interpreter) also lies at this address. It would take some special finagling with address 1, using machine language programming, to make the ROM disappear. But in many cases, you don't need to worry—you'll want to store to the screen, but won't need to read it back.

Addresses 49152–53247 are easily accessible.

The area from location 53248 to location 57343 is quite hard to get at, since it conflicts with the I/O chips. For example, remember the screen background POKE at address 53280? You would need to disconnect the I/O to get at this area, and that takes very careful work indeed. It can be done, but it's not practical for BASIC programmers.

From 57344 to 65535, the top of memory, we have a situation similar to that of location 40960: ROM (the Kernal system) makes it easy to POKE to this RAM but difficult to PEEK. Again, this may not be a problem for you.

Video Setup 64 is handy for screen arithmetic. It helps with much more than the simple exercises we've tried in this article. You'll really appreciate it next time you need to work with graphics and custom character sets.

See program listing on page 140.

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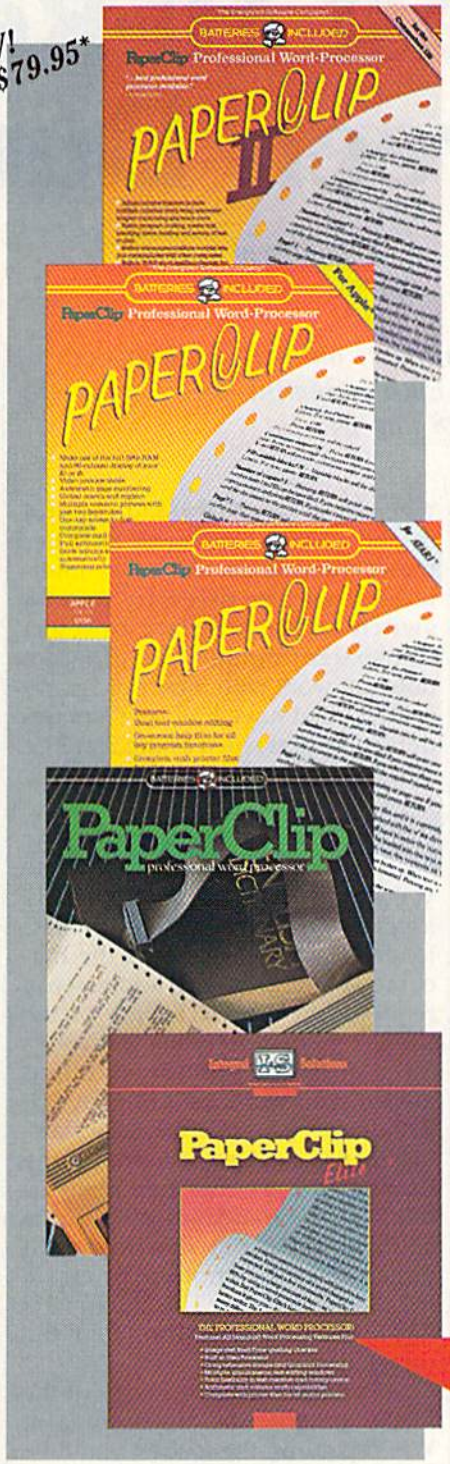

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Fast Hi-Res Screen Dump

Robert F. Mills

This machine language program prints out screen dumps at high speed when used with the Epson, Gemini, and compatible printers. For the Commodore 128 and 64.

The "Hi-Res Dump" program in the July 1986 GAZETTE prints out excellent copies of whatever is on the hi-res (high-resolution) screen. Unfortunately, the program is very slow when used with a non-Commodore printer like my Gemini 10X with its Cardco +G interface. The interface emulates the Commodore graphics commands well—but the process is slow and it gives the printhead quite a workout. So, I dug out my printer manual to learn more about its built-in graphics capabilities. "Fast Hi-Res Dump" is the result.

Although I wrote this program for my Gemini printer, it also works with most other Star Micronics models, and with most Epson printers as well. In fact, the program will work with most any printer that uses the ESC K *n1 n2* sequence for printing graphics. Refer to the owner's manual that came with your printer for details of its built-in graphics capabilities. (If you have a Commodore printer, do not type this program in. *It will not work with any Commodore printer.*) Regardless of the printer used, you must also have an interface which allows a transparent mode of operation. Transparent mode makes the interface pass all characters to the printer without modification. This gives you control over the printer's special built-in functions. This program uses the Cardco convention whereby a secondary address of 4 in the OPEN statement specifies transparent mode. For other interfaces, it may be necessary to set a switch on the interface to select transparent mode. This program does not work with most third-party printers that have built-in Commodore interfaces, such as the Star SG-10C or Gemini II.

Printing A Screen

Fast Hi-Res Dump is relocatable, so you can put this program nearly anywhere in RAM. The BASIC loader program will place the machine language at any address you request. On the 128, either of the RS-232 buffers (starting addresses 3072 or 3328) provide excellent areas if you won't be using an RS-232 device. The free memory starting at 4864 can also be used. For the Commodore 64, the free memory beginning at address 49152 is a good place to put this routine if your screen or another program isn't located there. The program is 221 bytes long, so it won't fit in the cassette tape buffer.

Type in and save a copy of the loader program before running it. When you run the loader, you'll be asked to specify a starting address for the dump routine. The loader then POKEs the values into that area and checks for errors. Anytime you want to dump the image on the hi-res screen to the printer, just SYS to the address you specified for the dump routine. For example, if you placed the Fast Hi-Res Dump routine at 49152, use SYS 49152 to dump your graphics screen. This can be done either in direct mode or within a program. The dump takes just over a minute. On the 128, you can BSAVE (binary save) the routine and then BLOAD it wherever you wish without having to use the loader program again. For example, if you told the loader to place the routine at address 3072 ($0C00), the RS-232 input buffer, you could save a copy of the routine with:

```
BSAVE "FASTDUMP",P3072 TO P3293
```

Then when you want to use the routine, just BLOAD "FASTDUMP" and SYS 3072. Or, if you have another ML program residing at 3072, you can use BLOAD "FASTDUMP",P *address* and SYS *address*, where *address* is some other free ML area. For the 128, make sure that the routine is loaded into a bank configuration where Kernal ROM is visible (bank 15, for example).

Behind The Dump

Fast Hi-Res Dump is written entirely in machine language. First, the program opens a channel for talking to the printer (equivalent to OPEN 4,4,4 in BASIC). The secondary address of 4 puts the Cardco +G interface in transparent mode with line feeds. If you don't have a Cardco interface, you may need to change the DATA in line 70. Replace the 4 in that line with the secondary address value that puts your interface into transparent mode. (You can ignore this change if your

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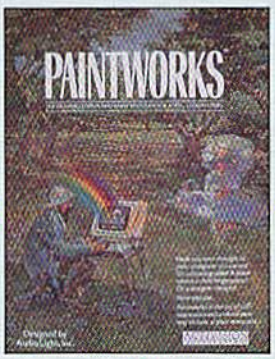

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printer interface instead requires a switch setting to select transparent mode.) If you do change line 70, remember to change the total in line 40 to reflect the new value. Otherwise, you'll get a false error message when you run the program.

Next, the routine sends the character codes to set up the printer for 8/72-inch (versus the normal 9/72) line feed length to account for the fact that the Gemini print head has nine vertical firing pins. (It's more convenient when working with the Commodore graphics screen to deal with only eight.) Changing the line feed length removes the gaps between the lines.

At the beginning of each column to be printed, the sequence ESC K *n1 n2* is sent to the printer. The expression *n1* + *n2* × 256 gives the number of characters to follow. The program sends ESC K 200 0 for each column because there are 25 rows in the hi-res screen, and each row has eight lines (25 × 8 = 200).

The program prints the screen contents sideways on the paper, with each printed dot corresponding to a lit pixel on the screen. The program scans from the top right corner of the screen down to the bottom right corner, through 25 rows of 8 lines. The address of a particular byte in the screen is (320 × *row*) + (8 × *column*) + *line* + *base*, with *column* ranging from 0 to 39, *row* from 0 to 24, and *line* from 0 to 7. The *base* address is the starting address of the screen bitmap. As written, this is assumed to be 8192 ($2000). If you want to dump a hi-res screen located elsewhere, just change the 32 at the end of line 240 to the high byte of the starting address of your screen. For example, if your screen is at 16384 ($4000), then change the 32 to 64. (As before, you'll also have to adjust the total in line 40 to reflect the new value.)

Note that there is a one-to-one relationship between the printed dots and pixels; this makes the final printed copy about 4 × 5 inches.

Like most hi-res dump programs, this program can't be used to dump text screens or sprites, but its speed, small size, and portability make it a very useful and powerful utility.

See program listing on page 140.

Sprite Locater

Stanley Brewster, Jr.

Even with a sophisticated sprite editor, locating your newly designed sprites can be a tedious chore. This machine language utility makes it easy. For the Commodore 64.

Although sprites are one of the most powerful features of the 64, they are also one of the most difficult to program. Fortunately, there are many good sprite editors available. These editors make sprite design easy, but they don't help you find the right place for them on your screen. "Sprite Locater" makes this chore an easy and simple task.

The Hard Way

The *Commodore 64 Programmer's Reference Guide* explains the process of sprite placement on pages 137–143 and 156–161. The explanations and graphs are well done, but the procedure is tedious. In order to place a sprite, you must know the row and column number of the character position where you wish to place it, and then add offsets according to the pixel position within that character. Most programmers just skip this method and use a trial-and-error approach. With Sprite Locater, you can use a joystick to find the perfect place for your sprite.

Type in and save a copy of the program. After you've done this, load it and type RUN. A crosshairs sprite appears. Use a joystick in port 2 to move the sprite. Its position is displayed on the top line of the screen. If you move the sprite from left to right across the screen, you'll see that as you get approximately two-thirds of the way across the screen, the *x* position drops abruptly from 255 to 0. To the right of this imaginary line you must set the appropriate seam bit as well as setting the reported *x* and *y* locations. The seam bit is the ninth and highest bit specifying the horizontal position of a sprite—necessary because there are more than 256 possible horizontal positions. All eight sprites have seam bits in location 53264/$D010. Refer to the *Programmer's Reference Guide* for more information.

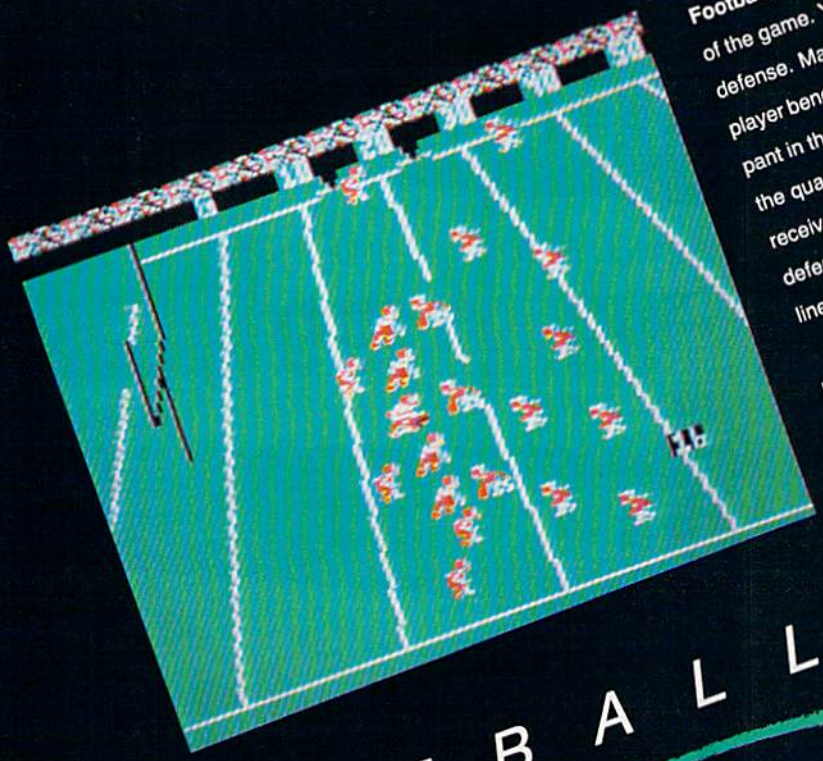
The speed of the sprite cursor is also displayed. Change the speed by pressing the fire button on the joystick. Use speed 1 (the fastest) to quickly traverse the screen. Use speed 15 (the slowest) when trying to home in on the exact spot for your sprite. Press any key to end the program.

On Your Own

The best way to use Sprite Locater is in conjunction with a previously designed background scene. For example, if your screen is a room with a stool in it and your sprite is a cat, you can find the correct coordinates for your sprite simply by using the joystick to put the cat on the stool. Here's how to do that: Load and run Sprite Locater. Exit the program by pressing any key. Load your background scene, making sure not to disturb memory above 49152—the address of Sprite Locater. Type SYS 49152 to restart the program. You may now move the sprite around the screen and note its location. Of course, you'll want to substitute your own sprite data in the program for mine.

You can also append this program to your own, but be aware of potential memory conflicts. The program uses RAM locations 832–895 for sprite information and locations 49152–49486 for the sprite-position reporting routine.

See program listing on page 130.



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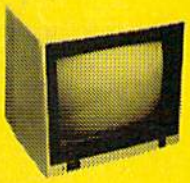

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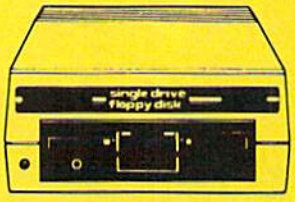

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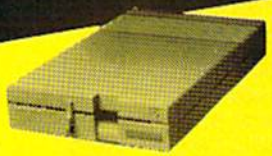

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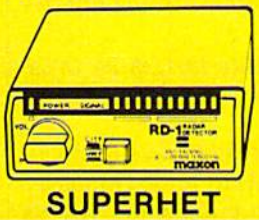

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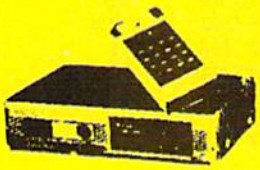

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machine language for beginners

Richard Mansfield
Senior Editor

Last month we built a small, but potentially useful, program which tests RAM memory. It stores to, then tests, each RAM memory cell by trying out every possible number (0–255) which can be held in a single byte. Then it moves on to the next cell. If any cell fails the test, the program reports the address of that cell and stops.

Now let's modify the program a bit. Let's make it more friendly by adding a message at the start of the program and, to show that it's making progress through the test, let's have it print a dot onscreen each time it completes a *page*, a 256-byte-long unit of memory.

Here's the original program from last month (for the Commodore 128 or 64):

```
10000 LDA     #4
10002 STA     253
10004 LDA     #0
10006 STA     252
10008 TAY
10009 TAX
10010 STA     (252)Y
10012 CMP     (252)Y
10014 BNE     10037
10016 DEX
10017 BEQ     10023
10019 TXA
10020 JMP     10010
10023 INY
10024 BNE     10010
10026 INC     253
10028 LDA     253
10030 CMP     #8
10032 BNE     10010
10034 JMP     10044
10037 LDA     253
10039 LDX     252
10041 JSR     36402 (JSR 48589 for the
                    64)
10044 RTS
```

This version tests just screen RAM because we stuck the limits of the test $0400–$0800 (1024–2048 decimal) right into the program itself. (See 10000–10006 for the starting address and 10030 for the ending address. For a complete description of the program, please see last month's column.)

Do Not Disturb

One of the most rewarding aspects of knowing machine language programming is that you can modify commercial software to suit your needs. You might want to add a feature to your word processor, for example, so it will automatically print addresses on envelopes. But how can we modify a program without disturbing it? The easiest solution is to cause the program to jump to a custom subroutine (outside the memory zones used by the original program) and then replicate the instructions you had to overwrite to cause your JMP.

In "Ramtest," we're going to put JMP 10050 right on top of LDA #4: STA in lines 10000–10002. We're going to cover up the first three bytes of our program with this JMP, print our message, and then (before returning to address 10004) replicate the LDA #4: STA 253 which we patched over.

Here's the new version:

```
10000 LDA     JMP 10050
10003 NOP
10004 LDA     #0
10006 STA     252
10008 TAY
10009 TAX
10010 STA     (252)Y
10012 CMP     (252)Y
10014 BNE     10037
10016 DEX
10017 BEQ     10023
10019 TXA
10020 JMP     10010
10023 INY
10024 BNE     10010
10026 INC     253
10028 LDA     #46
10030 JSR     65490
10033 LDA     253
10035 CMP     #57
10037 BNE     10010
10039 JMP     10049
10042 LDA     253
10044 LDX     252
10046 JSR     36402 (JSR 48589 for the
                    64)
10049 RTS
10050 LDY     #0
10052 LDA     10071Y
10055 BEQ     10064
10057 JSR     65490
10060 INY
10061 JMP     10052
10064 LDA     #47
10066 STA     253
10068 JMP     10004
10071 .... TEXT HERE (SEE BELOW)
```

Enter the program as is if you are using the "Simple Assembler," found in this column in the October issue. For other assemblers, you'll need to enter a comma in front of any Y (for example, 10052 LDA 10071,Y).

The Print Patch

As you can see, the program remains substantially the same, but there are some differences. For one, we are asking the program to check memory from page 47 to page 57, rather than checking screen RAM. And there's that JMP at the start of the program which sends us down to print out our message.

Lines 10050–10068 are new. They're the print-to screen patch. First we put a zero into the Y register so we can use it to pick off each letter of our message (starting with the first letter, the zeroth letter). Then we load in the first character with LDA 10071Y. This means load the character in address 10071 *plus the value of* Y. So, the first time through this loop, we'll load the character at 10071 itself because we put a zero into Y. Our message consists of the letters RAMTEST, which you'll need to POKE into addresses 10071–10077 in the following fashion:

POKE 10071, 82:POKE 10072,65 and so on, using **77,84,69,83,84,** and ending with **POKE 10078,0.**

There are easier ways to do all this, but it's helpful to do things by hand at first, to understand what's involved. That final zero, by the way, is important. It's not a printable character; rather, it tells the computer when our message is finished. Right after we load in each

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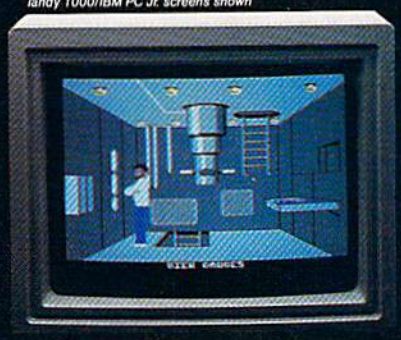
Tandy 1000/IBM PC Jr. screens shown

"0300 Hours. Two hours until dawn. Radar picks up convoy, escorted by two destroyers. We believe that one of the enemy's valuable cargo ships is part of convoy formation."

"0400 Hours. Lookouts on the bridge. Target identification party reports one cargo ship, 4,000 tons, troopship of 10,250 tons, with two *Kaibokan*-type escorts. Moving into attack position."



"0500 Hours. Sound General Quarters! Battle stations manned. Preparing for torpedo run. Gauge Panel OK. Periscope OK. Charts and Attack Plot Board OK. All mechanical systems OK."

"0525 Hours. Torpedo rooms report full tubes forward and aft. Battery at full charge for silent running. We hope water temperature will provide thermal barrier to confuse enemy sonar."

"0600 Hours. We are at final attack position. Convoy moving at 10 knots. Target distance decreasing rapidly... Crash Dive! Escorts have spotted us and are turning to attack! Rig to run silent."

"0700 Hours. Depth charged for one hour. Some minor damage, but repair parties at work. Destroyer propeller noises receding. We'll come to periscope depth for our return punch."

"0715 Hours. Torpedo tubes 1, 2, 3 fired. Two destroyers hit and sinking. One of the enemy's last cargo ships coming into 'scope view — an ideal target position. On my mark... Fire Tube 4! Fire 5!"

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character, we first check to see if it's a zero (via that BEQ, Branch if EQual to zero, in line 10055) and, if so, exit the loop by branching to 10064. However, if we're still printing the message, we JSR to the built-in BASIC print routine to deposit the character onscreen, raise the value of Y by one (INY) so it points to the next character, and JMP back to the start of this little print loop.

When we finish printing RAMTEST, we'll load the zero, thus triggering the BEQ and branch down to store 47 (the start address of our test) into the pointer discussed last month. Then we return to the original testing routine.

One other modification has been made. We've inserted lines 10028–10030 which load the Accumulator with the period (.) character and print it (again using BASIC's print routine). This happens each time we have finished a page of testing.

Eighty-column 128 users can type FAST prior to activating Ramtest. Forty-column 128 owners and 64 users will find that, at normal speed, the program takes about 16 seconds to finish its testing. Start Ramtest by SYS 10000.

All programs listed in this magazine are available on the GAZETTE Disk. See elsewhere in this issue for details.

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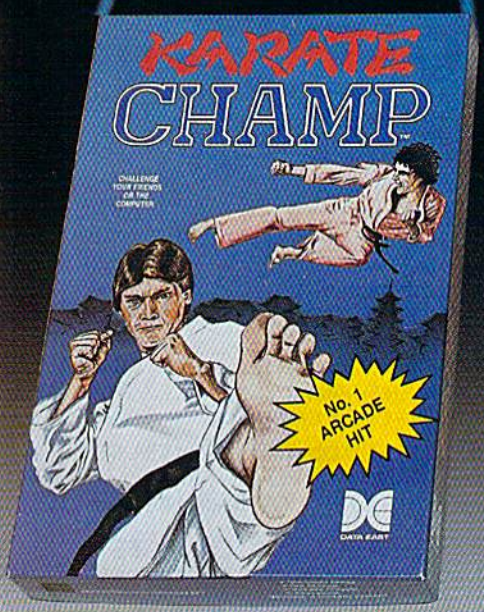

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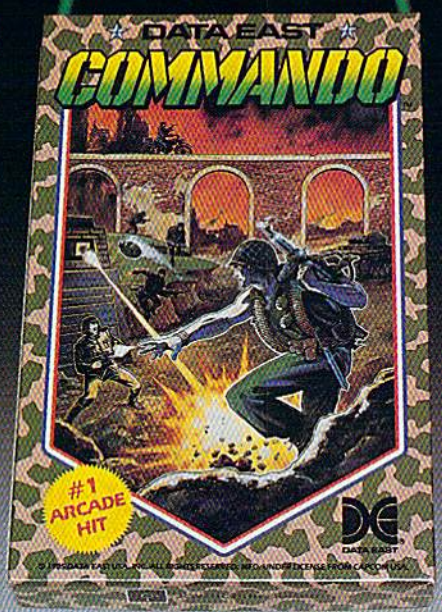

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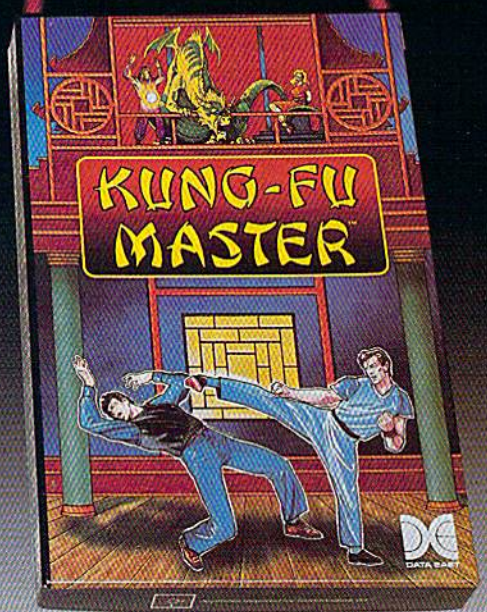

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Positioning The Cursor

Douglas W. Brown

There are several ways to put the cursor at a certain location on the screen. You can POKE a couple of locations, SYS to the Kernal PLOT routine, or do something like this:

```
PRINT "{HOME}{DOWN}{DOWN}
  {RIGHT}{RIGHT}{RIGHT}";
```

But what happens when you finish the program, put it aside, and three months later decide you want to add some features?

A program full of POKE and SYS statements isn't very readable—and it's not much fun looking for memory locations in a book, trying to remember what the program was supposed to do. A line full of {DOWN}s and {RIGHT}s isn't very readable, either. The reverse graphics characters that represent cursor movements in quote mode blend together when you have several in one line.

Here's another way to position the cursor. It's not necessarily any faster than other techniques, and it might use up a little more memory. What's good about it is that the listing is very easy to follow. For example, to put the cursor at line 10, column 12, and print HELLO, you'd use the following line:

```
60 PRINT LN$(10); CL$(12); "HELLO"
```

This won't work until you set up the arrays, of course. To create the arrays LN$ and CL$ (for lines and columns), add this short subroutine to your program:

```
1 GOSUB 60000
59999 END
60000 F = 0: LS = F+24: CS = F+39
60010 DIM LN$(LS), CL$(CS)
60020 LN$(F) = CHR$(19)
60030 CL$(F) = ""
60040 FOR X = F+1 TO LS
60050 LN$(X) = LN$(X-1) + CHR$(17)
60060 NEXT
60070 FOR X = F+1 TO CS
60080 CL$(X) = CL$(X-1) + CHR$(29)
60090 NEXT
60100 RETURN
```

Now you can move the cursor anywhere on the screen by using the arrays LN$ and CL$. The 25 lines are numbered 0–24; the columns, 0–39. If you prefer not to start counting at zero, change the first part of line 60000 to F = 1 (the columns will now be numbered 1–40 and the rows 1–25).

To see this technique in action, type in the subroutine above and add these lines:

```
10 FOR X = 0 TO 14
20 PRINT LN$(X);CL$(X);"*"
30 NEXT
```

Untwist A Renumbered Program

Michael A. Lang

The RENUMBER command on the 128 is a delight, but using it makes it tough to find the new starting line number for subroutines and other sections of your program. This is my solution:

```
10 GOTO 100
20 GOSUB 1000: INITIALIZATION
30 GOSUB 2000: OPEN DATA FILE
40 GOSUB 3000: SORT ROUTINE
99 REM MAIN ROUTINE STARTS
   BELOW
100 ...
```

The GOTO in line 10 jumps right to line 100, which means lines 11–99 are never executed. But the 128 doesn't know that and modifies those lines when you renumber. After renumbering is finished, press F7 to list the program and then hit the NO SCROLL key to pause the listing. You'll see what amounts to a menu of subroutines and their starting line numbers.

If you have a renumbering utility for the 64, this trick will also work in 64 mode.

This is especially useful when it's been a few weeks since you last examined a program. The first few lines provide an overview of how the program is organized.

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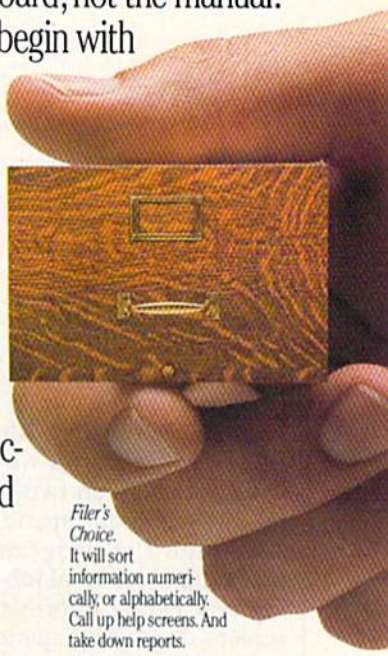

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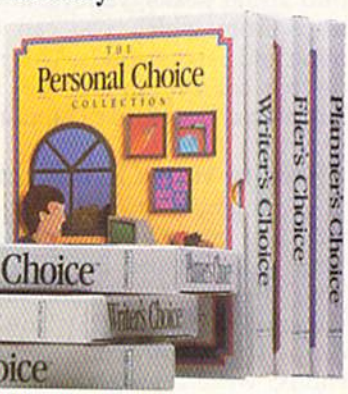

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Bar Charter

Raymond Jacob

Get a new perspective on data generated by your applications program—graph it with this easy-to-use vertical bar chart routine for the 64.

About a year ago, my wife and I started keeping our banking records on disk using a program I wrote. Recently, my wife suggested that it would help if we could look back over a given two-month period and view our spending trends. Although the program we were using did a beautiful job of organizing and listing information on the screen, displaying spending trends was well beyond its abilities.

A file of running balances contains patterns that could be discovered more easily if the numbers were translated into a more visual form. Displaying the file as a vertical bar chart transforms numbers into visual peaks, valleys, and plateaus from which you can determine and assess trends. This makes the bar chart a popular tool in the business and scientific communities.

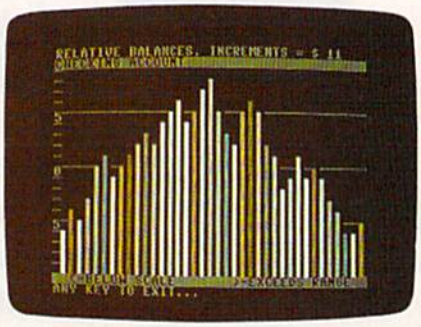
Charting Your Own Numbers

Your programs can use "Bar Charter" to help you identify patterns in your data. To use Bar Charter in your program, type in and save Bar Charter beginning at line 1000 (omit lines 100–160). Now you should write a program to call the Bar Charter subroutine. Have your program dimension array B( ) to the number of increments to plot (maximum of 38) and assign the values to be graphed to the elements of array B. Then GOSUB 1000 whenever you need to display a chart. When the routine is called, it turns the border and background color black.

An Example

As a demonstration of the routine, I've included a few program lines at the beginning of the listing to act as a main program from which the chart routine gets its data. Just type in the entire program and run it for a demonstration. Imagine that our main program is one that calculates and displays the running balances of a checking account based on a transaction file. For convenience' sake, our transaction file is encoded in the program as DATA statements (lines 120–160). Positive numbers are deposits; negative numbers are withdrawals.

In this example, the chart routine is being used to display 38 running balances as bars on a chart divided into 19 increments. Each increment represents the dollar amount—called the *increment value*—by which to measure and compare the lengths of the bars. Since our transaction file causes running balances to range between $40 and $200, the routine has to proportionately reduce each running balance to fit it within the confines of the chart before drawing the bar. The increment value divided into each running balance must return a number less than 20 in order for a bar to be drawn. Otherwise, a > is plotted to indicate overflow. Obviously, the increment value is dependent upon the size of the values to be graphed, so the routine prompts you to set the increment value each time the routine is called. This lets you select the viewing scale. Setting the right increment value means that all balances are displayed as bars using the smallest increment value possible. In our example, the best graph is made by setting the increment value to 11, but try other values to see what happens. Feel free to change the numbers in the DATA statements to see the effects.



Graphing your data with Bar Charter gives you a new perspective on numbers. This photo was generated by the demo program with an increment of 11.

This routine has made my home-budget program more useful by changing it from a mere record organizer into a bona fide analysis tool. It could do the same for your programs.

See program listing on page 140.

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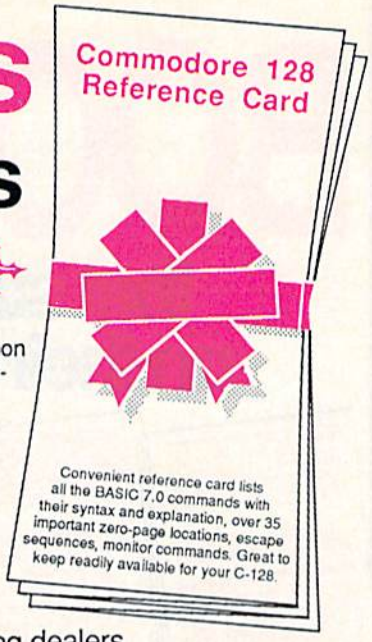
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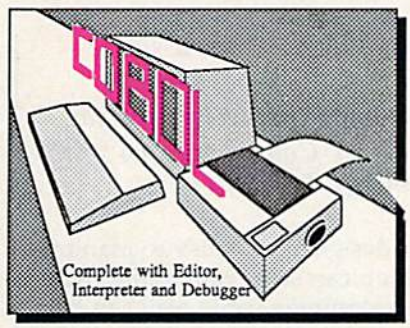

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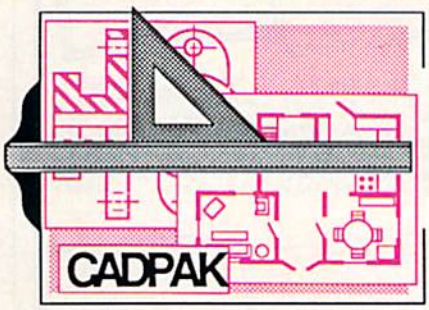

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Sprite Graph

Chris Stoy

If you use graph paper rather than a sprite-designer program, this short program will prove handy. It prints out custom graphs for designing sprites. For the Commodore 64 with a Commodore or compatible printer.

Once a sprite has been designed, it's easy to manipulate. A simple BASIC loop can send your sprite flying across the screen. But designing a sprite well can be a chore. There are many sprite editors available, but if you don't have one handy, you must design your sprite on graph paper, or—worse yet—notebook paper. If you need to create a lot of sprites, this can be very time-consuming. "Sprite Graph," a short BASIC program that accompanies this article, prints out crisp, clean sprite graphs on your Commodore or compatible printer.

Printing The Graphs

Type in Sprite Graph using the Automatic Proofreader found elsewhere in this issue. When you've finished typing, save a copy to tape or disk. Before you run the program, be sure your printer is on and there's paper in it. (Printing with no paper in the printer can damage your printhead.) If you're using a printer interface, it may be necessary to adjust it to emulate Commodore printer commands.

After loading and running the program, you're asked how many graphs you want printed. Depending on your printer and the length of the paper, you can fit an average of three graphs per page. If you wish to stop printing a graph, press and hold the RUN/STOP–RESTORE keys. Don't be concerned if the printing doesn't stop immediately; whatever characters are still in the buffer (a holding zone) must finish printing out. You should avoid turning off the printer while it is printing.

If the program doesn't work on your printer, make sure the CHR$ codes used in the program are the same as those required by your printer.

See program listing on page 130.

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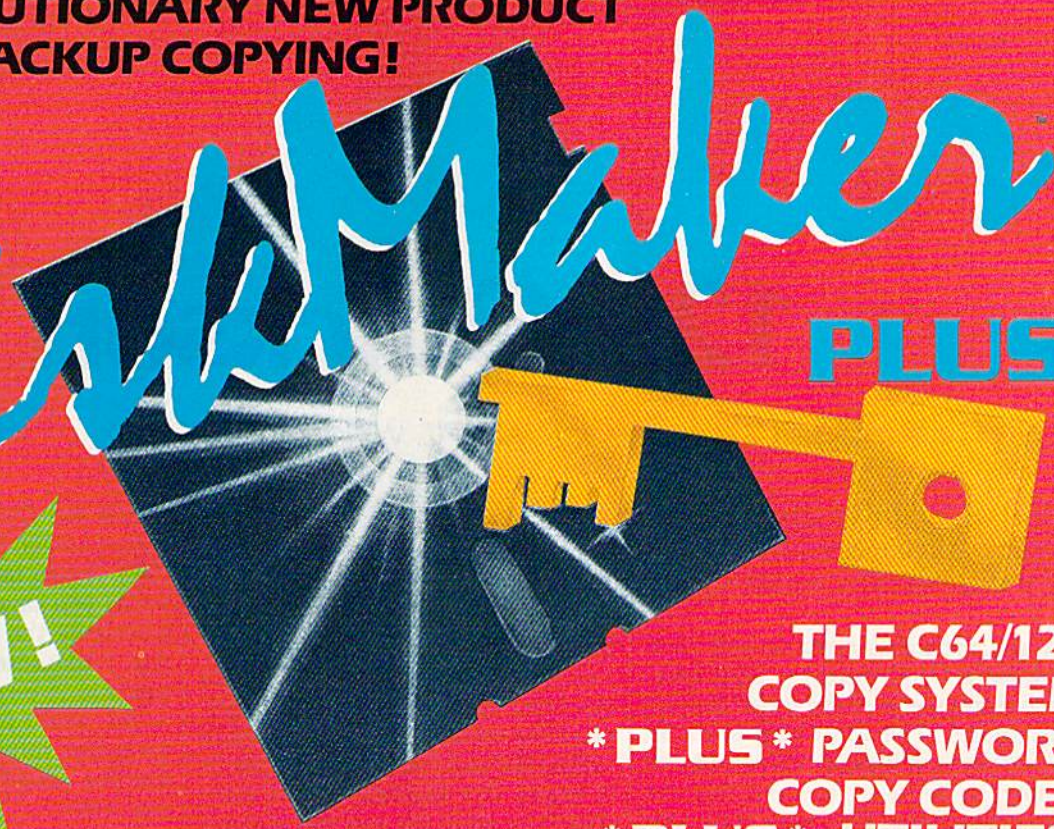

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128 Quicksort

Alton C. Williams

Sort at lightning speed on the Commodore 128 with this machine language routine. It utilizes the fastest sorting method for most microcomputer applications.

Many programs need to sort data. Mailing lists, indexes, and databases are some of the most obvious examples. The most common sort routine—the bubble sort—is far too slow to be used for any but the smallest jobs. The next time you write a 128 application that requires a sort, use "Quicksort."

This program is written entirely in machine language for maximum speed. It sorts any array of strings. Each element of the array may be up to 80 characters long.

Typing It In

Because Quicksort (Program 1) is written entirely in machine language, it must be entered using the "128 MLX" machine language entry program found elsewhere in this issue. Be sure to read the instructions for using MLX before you begin entering data. When you run MLX, you'll be asked for a starting and an ending address for the data you'll be entering. The correct values for Quicksort are as follows:

Starting address: 1300
Ending address: 17D7

After you've entered all the data, be sure to save a copy before leaving MLX.

To use the Quicksort routine, you must first load the program with a statement of the form BLOAD "QUICKSORT" (substitute whatever filename you used when you saved the program). After dimensioning an array and filling it with data—an address list, for example—you're ready to use Quicksort. In addition to the SYS address, you must also supply the name of the array to be sorted, the number of items to sort, and the element within the array at which the sort is to begin. For example, if the variable N contains the number of items in the string array AA$(I) and the variable N1 contains the number of the element at which sorting is to begin, you would use the following statement:

```
SYS 4864,,,,,N,AA$(N1)
```

The five commas after the 4864 are necessary because of the 128's versatile SYS command. The commas bypass SYS parameters that Quicksort doesn't need. Of course, you don't have to use the same variable names I used, and numbers may be used instead of the variables N and N1.

After the SYS command is executed, the array items are sorted in ascending order starting with AA$(N1).

Quicksort sorts arrays containing thousands of items in a matter of seconds. But for maximum speed, use the FAST command before beginning the sort. If you're running your program in 40-column mode, the FAST command blanks the screen until the SLOW command is executed. FAST doesn't disable the 80-column screen. Here's an example of using FAST to speed things up:

```
FAST:SYS 4864,,,,,N,AA$(N1):SLOW
```

Program 2 provides a simple demonstration of Quicksort. Line 10 of Program 2 assumes that you stored the Quicksort machine language under the name SORT 128 .OBJ. If you used some other name when you saved the file with MLX, substitute the proper name in that line. Make sure a copy of the Quicksort file is on a disk in your drive when you run the program. This program shows the speed of the routine. Here are some typical sorting times:

10 strings	**.067 seconds**
100 strings	**.833 seconds**
1000 strings	**12.083 seconds**

Don't try to specify more than about 4000 elements for the array when using Program 2. If you do, you'll probably crash the program with an OUT OF MEMORY error message.

A Safety Test

Besides the area needed to store the machine language program ($1300–$17D1), this routine uses very little memory. The actual amount it needs depends on the number of elements it's sorting. It needs only about 120 bytes to sort an array of 1000 strings. The memory used is borrowed from the variable storage area while the sorting is done. Your BASIC program will never know that it was used. However, if your variables are using all of the nearly 64K of variable space (which is very unusual), then there may not be enough memory available to do the sort. Every time it executes, Quicksort sets a flag which your program may check to determine the success of the sort. After the SYS command is executed, you can check the value in memory location 250. If PEEK (250) is not equal to 0, there was insufficient memory, and the sort is invalid.

See program listings on page 139.

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Mastering 128 Sound And Music

Part 3

D. C. Holmes

In this installment, the author demonstrates how to modify sound on the 128 by using the ENVELOPE statement. Two programs are included.

The frequency of a sound wave is the property which determines its pitch. What we hear as a high-frequency sound we call a high note and a low-frequency sound a low note. The ear is sensitive to other characteristics as well, and can distinguish between different instruments playing the same pitch. All of us, for example, can tell the difference between middle C struck on the piano and middle C bowed on the violin.

The peculiar properties of a sound which enable us to make this differentiation include its *timbre* (waveform) and amplitude qualities (ADSR—Attack, Decay, Sustain, and Release). Through manipulation of 11 variables related to waveform and ADSR, a seemingly infinite number (actually about 70 trillion) of individual voice registrations are possible on the 128. Professional synthesizer players refer to each of these combinations as a *patch*. Control of these variables in BASIC 7.0 is achieved using the ENVELOPE and FILTER statements.

The amplitude variations throughout the duration of a sound are described by the ADSR values. *Attack* is the rate at which the volume rises to its peak. The volume then decreases to a plateau (*sustain*). The rate at which this decrease occurs is the *decay* rate. The amplitude decreases again from the sustain level down to zero volume. The rate of this final decay is the *release* rate.

The timbre of a sound is determined by its waveform. The 128 can produce four types of waveforms (triangle, sawtooth, square, and noise). Waveforms can be modified with the FILTER statement.

The format for the ENVELOPE statement is:

ENVELOPE *n,a,d,s,r,wf,pw*

where:

n = envelope (0–9)
a = attack (0–15)
d = decay (0–15)
s = sustain (0–15)
r = release (0–15)
wf = waveform (0 = triangle, 1 = sawtooth, 2 = pulse, 3 = noise, 4 = ring modulation)
pw = width for pulse waveform (0–4095)

These parameters are initialized to the following values in the 128's ten default envelopes:

If you're unfamiliar with the sounds of the default envelopes, you may want to run "The Magic Flute," a demonstration program from Part 1 of this series. It gives a sampling of the 128's preset envelopes. Once you can distinguish the differences between these sounds, the effects of changing the various parameters are more easily understood.

Parameter Values

Here's an explanation of the ENVELOPE parameters:

a (attack, 0–15) is the rate at which a note reaches its peak volume. Note that the value of *a* is initialized to zero in the piano, calliope, drum, guitar, harpsichord, organ, and xylophone. The attack is instantaneous for these sounds, creating a percussive effect. For the preset accordion, flute, and trumpet envelopes, the attack is gradual; the notes sneak in gently. As the value of *a* increases, the attack becomes softer.

d (decay, 0–15) describes the rate at which the volume of a sound de-

	n	a	d	s	r	wf	pw	envelope name
ENVELOPE	0,	0,	9,	0,	0,	2,	1536	piano
ENVELOPE	1,	12,	0,	12,	0,	1		accordion
ENVELOPE	2,	0,	0,	15,	0,	0		calliope
ENVELOPE	3,	0,	5,	5,	0,	3		drum
ENVELOPE	4,	9,	4,	4,	0,	0		flute
ENVELOPE	5,	0,	9,	2,	1,	1		guitar
ENVELOPE	6,	0,	9,	0,	0,	2,	512	harpsichord
ENVELOPE	7,	0,	9,	9,	0,	2,	2048	organ
ENVELOPE	8,	8,	9,	4,	1,	2,	512	trumpet
ENVELOPE	9,	0,	9,	0,	0,	0		xylophone

creases from its peak level to its sustain level. Note that the value of *d* is initialized to zero in the accordion and calliope. Notes played in these envelopes maintain peak volume throughout the plateau, or sustain, phase. The rest of the preset envelopes decay at various rates to their sustain level.

s (sustain, 0–15) is the volume level a note holds from the end of the decay phase until the beginning of the release phase. In the cases where the value of *s* is 0 (piano, harpsichord, and xylophone), the volume decays completely to a zero volume level. Notes played in these envelopes have a staccato quality (staccato is a musical term indicating a series of notes in which each note is discontinued abruptly before the next note is heard), and a whole note sounds the same as a quarter note followed by a dotted half rest. When *s* is 15, as in the preset calliope envelope, the sustain volume is the same as the peak volume in the attack phase; there is no decay phase. Whenever *s* is 15, *d* must be 0, or unexpected cyclical decay-sustain effects will result.

r (release rate, 0–15) is the last phase in the duration of a note, and it follows the sustain phase. The value of *r* determines the rate at which the volume drops from the sustain level to zero volume. Note that *r* is preset to either 0 or 1 in all of the default envelopes. This means that the release occurs rather rapidly, and there is a good reason always to set *r* to a low value in musical programs. If a note is followed by another specified for the same voice, the SID chip will turn off the first note and switch to the next at the specified moment. If, however, a note is not followed by another, the SID turns off the last note according to the value of *r* for its specific envelope. For example, when *r* is set at 15, the final whole note in a piece may linger for a surprisingly long time.

wf (waveform) determines the timbre of the musical sounds produced by the 128. The SID chip is capable of generating sounds of four waveforms: *triangle* (wf = 0), *sawtooth* (wf = 1), *pulse* (wf = 2), and *noise* (wf = 3). The triangle waveform sounds warm and muted (calliope, flute, xylophone). The sawtooth waveform sounds bright (accordion, guitar) and is generally louder than the triangle. The sound of the pulse waveform is variable according to the pulse width (*pw*) specified. The noise waveform generates a nonpitched sort of sound which can be used to mimic drums, cymbals, and other percussion instruments. If *wf* is set to 4, a triangle wave is activated which is *ring-modulated* between voices. This is an interesting effect, but for now it will produce unwanted results if it's used in place of the other values of *wf* in our programs.

pw (pulse width, 0–4095) is specified only when the pulse waveform (*wf* = 2) is selected. This parameter designates the duration of each pulse, and a variety of harmonic effects can be produced (*pw* = 512 for harpsichord and trumpet; *pw* = 1536 for piano; *pw* = 2048 for organ).

This month's first program, "Custom Envelope," gives you an opportunity to adjust the ENVELOPE parameters and hear the result. Enter values for *a, d, s, r, wf* (and *pw* if *wf* = 2), and select a default (preset) envelope for comparison. The 128 plays an ascending C scale using the preset envelope, followed by a descending scale using your custom envelope. Then you can choose to play it again, select a different preset envelope for comparison, or change the parameters of your custom envelope. This should help to acquaint you with the ADSR and waveform elements of sound quality.

A Piano Is A Piano Is A...

Before the piano was invented, there was the harpsichord. It's a wonderful sounding instrument, but it has just one sound. Hit a key hard or touch it lightly—it sounds the same. Release a key quickly or hold it down—no difference. It has the same ADSR every time. That's why there was so much excitement when the piano was introduced. It's touch-sensitive, and all aspects of ADSR are within the control of a skilled player. The name *pianoforte* was coined for this instrument because you could play dynamic levels ranging from soft (piano) to loud (forte) and anything in-between. The name, of course, has been shortened to *piano* over the years.

The 128's preset piano envelope (T0) plays with a percussive attack, and a complete decay with no sustain. This is appropriate for staccato phrases, but legato and sustained parts aren't rendered true to the manuscript. In fact, the whole notes decay as rapidly as the quarter notes.

For this month's second program, "VF16," I've selected a Prokofiev composition for piano which features both staccato and legato passages. I specify the custom envelope in line 20:

```
20 ENVELOPE 0,0,9,2,1,2,1536
```

This is essentially the preset piano envelope, with the sustain level raised to 2 and the release rate changed to 1. These changes allow you to hold the long notes for their full value. Try entering one of your custom envelopes in line 20 and see how this sounds on your "instrument."

This Prokofiev piece, "Vision Fugitive XVI," has an eerie feel—although you'll notice that your 128 doesn't really sound much like a piano. We can make some unusual and entertaining sounds on the 128, but we'll never mistake it for a piano. If it's any consolation, remember that Horowitz can't use his Steinway to run a spreadsheet or vaporize aliens.

See program listings on page 142.

All programs listed in this magazine are available on the GAZETTE Disk. See elsewhere in this issue for details.

Partner 128

Partner 128, a cartridge-based desktop-accessories program from Timeworks, performs as advertised: the Commodore 128 equivalent of Borland's popular *Sidekick* desk-accessories product for IBM and Macintosh computers. And as the base of 128 productivity software grows, *Partner 128* may well become the most valuable utility you can have.

Residing in a ROM cartridge, *Partner 128* doesn't consume your computer's memory as do disk-based utilities, and yet it's always there, always ready, as you'd expect a partner to be.

Then, at the touch of a button, *Partner* will freeze the program with which you're working and present you with a bright, yellow-on-black menu that offers you a choice of Calendar, Calculator, Memo Pad, Screen Printer, DOS Shell, and more. Further, because it truly supports the use of two disk drives, there need be no disk swapping in order to call up information stored with *Partner*.

Partner 128 must be installed before turning on your computer and disk drive. This involves putting the cartridge into the game port of your 128 and plugging the attached cord into joystick port 2. (Because of this, *Partner* will not work with programs requiring their own cartridge. For programs that may require a dongle in port 2, Timeworks makes available a Y cable.) It's also necessary to have the program with which you're going to work in the disk drive and ready to be booted: *Partner* works only as a background to a disk-based program.

As you turn on your computer, there will be a very brief flash of *Partner*'s title screen, simply to tell you it's there and ready. Then it retires to its waiting place, and the autoboot sequence begins. Your program runs. To call up *Partner*, simply press the large white button on the cartridge.

Now the *Partner* menu appears, offering you eight categories of choices. Although it's last on the list, Choice 8—Setup—is probably the most important, for it allows you to set control codes for your printer, disk drive or drives, and modem. These settings can then be saved to disk (if different from the default settings) and thus loaded quickly during subsequent uses of *Partner*.

If you're using two disk drives, you can also set which drive will be used by *Partner*. In my case, my second 1571 drive is set as device 9. Whatever I do with my word processor will be saved to and loaded from drive 1 (device 8), but whatever I do with *Partner* will be saved to and loaded from drive 2. In this way, I can keep my formatted *Partner* disk in the second drive, and it's as unobtrusive as *Partner* itself is.

To take the other utilities in the order in which they appear on the menu, the first is Appointment Calendar/Date Book. Select it, and a calendar for January 1986 appears. The + key will increment the calendar one month at a time; the TAB key, six months at a time. The − and SHIFT-TAB keys will reverse the process. You can go up to December 1999.

Select a date with the cursor keys, press RETURN, and the screen flips to show you a Daily Detail display. Now you have a Title box, a place to list Key Tasks, a To Do list, and a place to schedule appointments. Once these have been filled in, save the information on a formatted disk and press the ESC key to return to the calendar. You'll notice that your title now appears in the date box, serving as a flag that will always be there when you load data for that month.

The Memo Pad is a mini-word processor with word-wrap, line insert and delete, and text formatting. Memos can be saved and printed, and a suggestion in the manual reminds you that you can use the Memo Pad to create your own help screens for various programs. There is also a Typewriter mode that may be selected. In using it, press RETURN after each line, and the line is sent directly to your printer.

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The Calculator presents you with an onscreen graphic representation of a hand-held calculator. Keypad or regular numbers may be used for entry, and the standard math operators (+, −, *, /, =) are used. If you wish, you may also print out a "paper tape" of your calculations.

Screen Printer takes your program, at the point where it was frozen by activating *Partner*, and dumps it to the printer. Though this is a screen dump, it's for text only, not graphics. This is not a handicap because, strictly speaking, there should be no graphics in 80-column mode.

SwiftDOS allows you to format disks, rename or erase data files, and initialize or validate a disk. In being able to do this without having to leave your main program for more than a few minutes, *Partner* is providing what is, in effect, a DOS shell. And SwiftLock gives you the option of setting up a code that puts your program on hold, allowing no keyboard entry until the code is reentered. This might be nice if your children swoop down on your computer every time you walk away from it.

We did our testing of *Partner* with three programs from Activision's Personal Choice line of software: *Writer's Choice*, *Filer's Choice*, and *Planner's Choice*, and experienced no problems. Undoubtedly, *Partner 128* will also work well with Timeworks' own 128 series of productivity software.

A personal tip: Some time ago I obtained a right-angle attachment for the game port of my 128. It's called 'LBO and is from a company named Marjac. In using *Partner 128*, I find this to be an ideal accessory, for the cartridge sits in a vertical position, and the activating button is easier to reach. Whether or not you use this method, *Partner* can stay in the game port, being disabled by removing the plug from the joystick port. This will allow you to free your 128 for 64 or CP/M applications, yet always have *Partner* close at hand.

The documentation is excellent, leading you step-by-step through the uses of each utility. Though you can create your own machine-language utilities for loading into *Partner*, the instructions carry only a message that this can be done. Registered owners of *Partner* may apply to Timeworks—in writing only—for further information and a utility disk. For everyday applications, if the documentation doesn't answer your questions, Timeworks will, through a toll-free help line.

In summary, we found *Partner 128* to be a valuable addition to the productivity applications of the 128, working as advertised and filling a real need. As a result, we feel Timeworks has another winner, and deservedly so.

(A Commodore 64 version of *Partner* should also be available by the time you read this.)

—Ervin Bobo

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Mystery! And *Castles And Creatures*

When I was in high school, almost weekly my English teachers used to say, "The best way to learn to write is to do it. WRITE." And since they were the bosses, we did as they said. Yet, that sounds so intimidating now. "Write." How do I do that? you say. Where do I begin?

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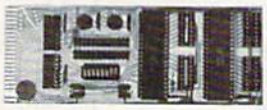

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Woodbury Software has introduced the PlayWriter series, a line of new writing programs that entertain you as well as give you practice writing. This series, which includes the two packages reviewed here—*Mystery!* and *Castles and Creatures*—leads you step by step in creating a short murder mystery or medieval fantasy. With the materials provided, you can print your story on special paper, illustrate it with stickers and pictures, and bind it into a full-color hard cover. Presto! You've produced your first book.

Actually, as PlayWriter's manual wisely advises, you're able to write several stories with each program. These can be saved to disk and/or printed out on regular printer paper. You can then choose your favorite to publish.

PlayWriter's technique is to guide you by asking questions. In some cases it offers you choices such as: "The hero of your story is a brilliant young detective. Do you want this detective to be a: (1) she? (2) he?" Other times it asks you to provide a few sentences to fulfill a certain purpose, say, describing the magic artifact missing from the castle. Occasionally, PlayWriter will offer to do the writing for you. Through it all, the program interacts with you. It calls you by name, asks you your most often-used expression, and inquires about your favorite dessert. Since there is a bit of a wait when loading segments, PlayWriter asks you riddles to pass the time.

You edit your story chapter by chapter in a word processor mode. You may do this as you write or after the whole story is finished. When you're through, you may print it onto printer paper or, if you're ready, on the booklet paper provided. If you don't have a printer, Woodbury will print your story on PlayWriter paper for a fee. Refill packs are available so that you may make more than one book.

PlayWriter's manual is one of the best short manuals I've ever seen. It's full of helpful hints and advice such as telling you exactly how many stories will fit on the master disk or on a disk dedicated only to stories. It provides clear examples of what you'll encounter in the program, including a list of the editing commands, their purposes and keystrokes. It anticipates questions and problems you may have and speaks to them clearly and succinctly. It illustrates how to put the book together. There is also a Trouble Shooting section. The solution that most endeared this manual to me was for the problem of master disk errors: Call Woodbury. That kind of technical support is much appreciated.

The printing selections include just about every possibility you could desire, from printing to your screen to printing on plain paper to printing on the booklet paper. It even offers the option of telling you if a paragraph is too long for booklet printing.

Mystery! and *Castles and Creatures* sometimes seem slow, even with an assist from aids like *FastLoad*. It takes time for these programs to move around all the text they have to handle. The word processor, especially the editor, is cumbersome. Having worked with regular word processing programs, it took a while to get used to this one. And switching disks when your story is not on the master disk can be awkward. A warning on switching disks: Some stories can be saved on the master disk. "Change story disk" *must be selected* before any other command when your story is on another disk; otherwise, you'll find yourself working on—or worse, *deleting*—the wrong story. The manual mentions this, but a reminder in the menu would be a big help. Only full stories can be deleted, not chapters. If you don't like what you've written, you have to start over.

Back to our English teachers' directive: "Write." Of what use are programs like *Mystery!* and *Castles and Creatures*? They provide a guide, an outline that coaxes you into writing. This outline draws parameters that limit you in length and content, yet leave you enough creative freedom to write your own story. *You* determine how much the computer does or does not do. In editing, you can rewrite entire chapters if you wish. Writing within limitations can be good discipline. Perfecting your ability to do that will help make you a good writer. For those who are so intimidated by the idea of writing they can't think of ideas and thus never start, the PlayWriter series is a beginning, a door-opener. Whatever your age, whatever the reason you wish to develop your writing skills, or even if you just want to have fun, *Mystery!* and *Castles and Creatures* provide delightful writing practice.

—*Robin Minnick*

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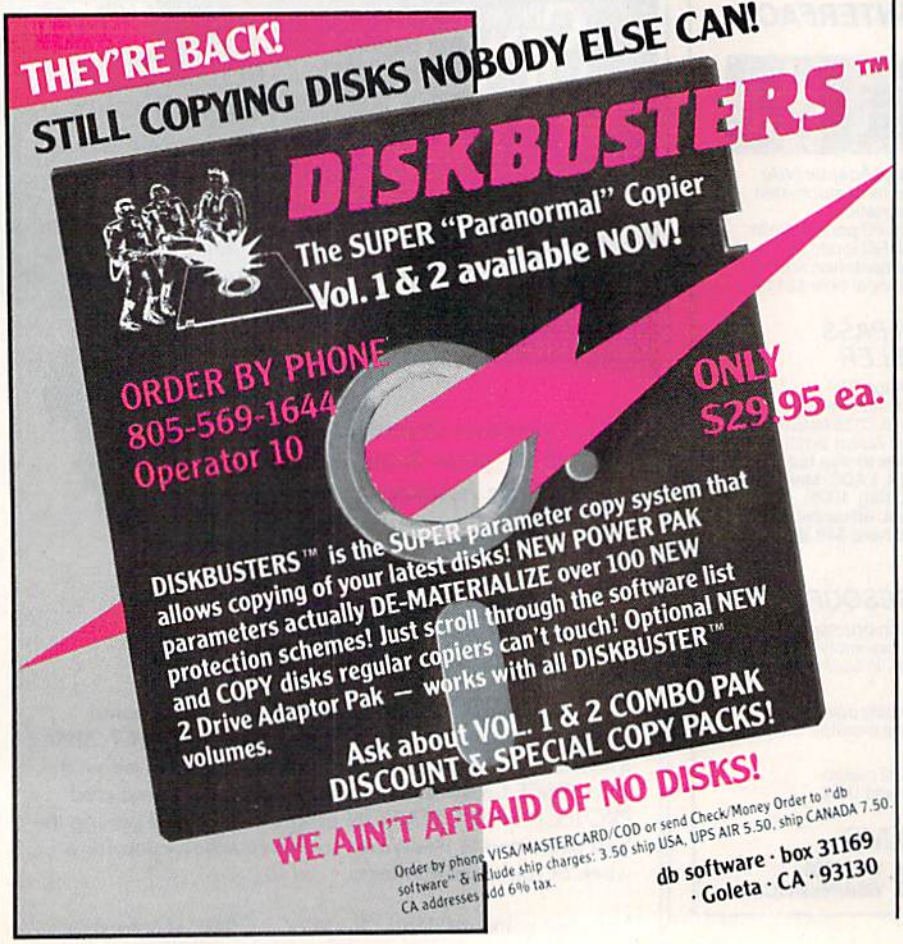
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Fontmaster II

As one of my friends likes to say, "A computer is a solution in search of a problem." In fact, many problems are conceived to be so difficult that we fail to consider how the prodigious power of the computer can be used to solve them. The problem of publishing attractive letterheads and manuscripts, previously solved by leaving large sums of money with the typesetter, can

be accomplished single-handedly with Apple's Macintosh and LaserWriter, currently selling together for slightly less than the average family station wagon. In other words, still too much for many of us to afford.

Fortunately, Xetec's *Fontmaster II*, an integrated word processing and printer utility program for the Commodore 64, can make do-it-yourself desktop publishing possible without totally draining the family's resources. Given some practice, a Commodore user can print very attractive letters, term papers, business forms, or any other type of document in any of the 33 different fonts (lettering styles) with this technically elegant program, including the Russian, Greek, and Hebrew alphabets, scientific symbols, and 29 Roman alphabets.

By using the included Font Creator program, other alphabets, such as Arabic, Devanagari, Cherokee, or Thai, can be created. By using the Character Set Creator program, they can be displayed on the screen, either left-to-right or right-to-left. The printout can even combine two languages written in opposite directions. Finally, since *Fontmaster II* allows the user to print a dot or any combination of dots from a dot-matrix printer in any conceivably useful location, up to nine different fonts can be created, allowing over 780 different character-sized blocks to be printed to form a very high-resolution picture.

As a word processor, *Fontmaster II* is simple to use, considering its many unique capabilities. The cursor is a hollow transparent square, which makes typing easier, and an ever-present display above the screen ruler informs you of the status of up to 22 different features. This display changes to one of four different help screens, depending on the combination of the Commodore logo, CONTROL, and SHIFT keys pressed. Blocks of text are marked at either end with a simultaneous CONTROL-M keystroke, enabling them to be cut, pasted, moved, copied, or displayed on an 80-column preview screen, or even printed out with ease. The block printout option makes it possible to determine the final appearance of the printout without trashing several feet of paper, and also allows addressing envelopes without retyping the address. Short deletions can be done with the INST/DEL key, which deletes the character to the left of the cursor. A simultaneous CONTROL-G will gobble unwanted characters to the right. There are speedier ways to remove entire lines and blocks of text as well.

Text layout is accomplished with over 50 two-character formatting commands, each preceded by pressing the English pound key, shown as a fat arrow on the screen. These formatters control margins, tabs, line spacing, proportional spacing, left and right justification, centering, and pagination, to mention the more common functions. The position and use of repetitive page headers and footers are also defined by formatters, and have 15 separate commands of their own. Page numbers, if desired, can be printed in either Arabic or Roman numerals, and printed in the center, or in the right or left margin. Desktop publishers will appreciate the option of printing headers and footers alternately on the left and right for correctly paginated, camera-ready copy.

Control over the printed output is where *Fontmaster II* really shines. The program sends each character to the printer in the Graphics mode, with each line requiring two passes of the printhead. The 33 fonts consist of 29 normal fonts and four "superfonts." Normal fonts are formed on a 9 × 16-dot matrix while superfonts are laid out 18 dots across. This double resolution gives the latter a smoother and clearer appearance than normal fonts. Each font or superfont can be printed in three heights: micro (half a line high), normal (one line high), and tall (two lines high). In addition, characters can be printed in three widths (compressed, normal, and expanded), and the pitch, or the spacing between the letters, can be set in the range of 10 to 13 characters

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per inch. The 13 CPI "konnect" pitch is particularly useful for the included script fonts and graphics. Subscripts and superscripts are also supported.

Unlike some other programs, *Fontmaster II's* centering, justification, and proportional-spacing features all work perfectly regardless of the character width or pitch selected. Up to nine font slots are available for each text file. Since superfonts occupy twice as much space, four of these and one normal font—or nine normal fonts—can be used in any single document. Fonts, widths, pitches, boldfacing, and underlining are selected by simultaneously pressing a key with the Commodore logo key, which displays an inverse field character on the 40-column screen.

Printer manufacturers and many software producers are apparently less than completely aware of how diacriticals such as accents, cedillas, and umlauts are used in foreign languages. Typically, printers will print some, but not all, of the accented vowels needed. Even if backspacing the printhead is possible, it is awkward, and not all word processors permit it. *Fontmaster II's* programmer, Marty Flickenger, thoughtfully provided two different ways to solve this problem. First, the accented vowels and inverted punctuation such as are used in Spanish can be defined as unused keys, such as @, &, or <. Second, any number of characters can be overlaid and printed simultaneously. This could be particularly useful for writing in a language requiring many diacriticals, such as Vietnamese.

Fontmaster II provides a great deal of versatility in other aspects of creating text. It's not necessary to decide when opening a file how many lines will be needed. Each file saved remembers which fonts were used, so after reloading a file, one need only type CONTROL-D followed by an N (for "fonts needed") to load them automatically. Fonts can be changed at any time. A text file can normally be up to 539 lines, or about 16 double-spaced pages long. Also, any font slots not used can be freed for 48 lines of additional text each. There is a formatter for chaining files together if this is not sufficient. CONTROL-? will inform the user how many bytes and lines of text remain available. The constant screen display provides this information in terms of the percentage of memory available.

It's also possible to print in up to four columns, to print form letters—retrieving variable data such as names and addresses from previously created sequential files, or to set the output for single-sheet printing. The RUN/STOP key is used as a helpful "panic button" that will abort printing and any other command.

The program provides an 80-column screen display, which can include variable data from the sequential files mentioned above. Although it does not actually show exactly what will be printed, this display comes close enough for most purposes, and includes headers and footers as previously defined. Actual "what-you-see-is-what-you get" displays require great amounts of memory, and are often more difficult to use than *Fontmaster II's* formatters and embedded nonprinting characters because of the need for calling up fonts from the disk and eliminating unneeded files. When you're typing text, a 40-column screen is used with the words broken at the edge of the screen. I found that this does not seem to be particularly disturbing after some use.

Fontmaster II cannot perform word, sentence, and paragraph counts. It does not have a provision for mathematical calculations, and there is no spelling checker included. It's possible to save text either as a standard *Fontmaster II* program file or as a sequential file before adding the font codes and formatters, and then run the text through various other spelling checker programs, resave it, and reload it into *Fontmaster II*. The columnar printing feature requires backing up the paper manually if your printer has no paper-reversing command, which is slightly awkward. I've also discovered that moving blocks of text about a long file while in the insert mode can cause a lockup and possible data loss. This is a generic admonition that I've found applies to every word processor I've used. As each line requires two uni-directional passes of the printhead, the printing process is somewhat slower. However, a fast dot-matrix printout is available for rough drafts.

Successful desktop printing with *Fontmaster II* depends on your printer, which must be capable of double-density graphics to use all of the available features. The setup file lists 79 printers and 18 interfaces, and has a test for experimentation with any of these, especially helpful if your equipment is unlisted. Interfaces do not seem to present a problem, and DIP-switch settings are provided for interfaces and printers alike. Nearly all of the newer Star, Epson, Citizen, and Panasonic printers will print both normal fonts and superfonts. Commodore's MPS-801, 803, 1525, and 1526 printers, as well as the Commodore-ready Star SG-10C, are not listed as being capable of fancy printing with this program. I have used it with Star SG-10, Gemini 10X, and Panasonic 1091 printers with MW-350, Cardco +G, and Xetec interfaces, with excellent results. It might be helpful to write Xetec for a list of supported printers. The normal fonts, though slightly less defined than the superfonts, print out quite acceptably with a well-inked ribbon. The screen, border, and text can be any color, and can be changed at any time, so a color monitor is not necessary. It might be somewhat difficult to read the 80-column preview display on some color TVs, however. A chime is used to alert the user to errors and to insert another single sheet of paper, so a speaker could be helpful, but is not essential.

Fontmaster II's manual is far more readable than others I've seen, and allows the user to begin printing right away with a useful series of tutorials, followed by introductory, intermediate, and advanced topics. It includes several handy appendices and an excellent index at the end. There are some rather spectacular text files included on the disk which illustrate how the more complex features work. Also included is

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You would compress text like this
Change to pica pitch
Select the pitch called "alternate"
This is the elite pitch
The Konnect pitch runs together
you **must** try boldfacing!
Trying the INVERSE feature
The second method of underlining
All of a sudden we change fonts

Go from normal to tall!
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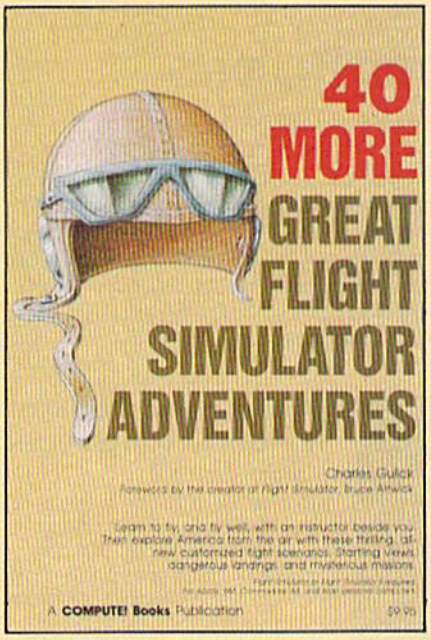

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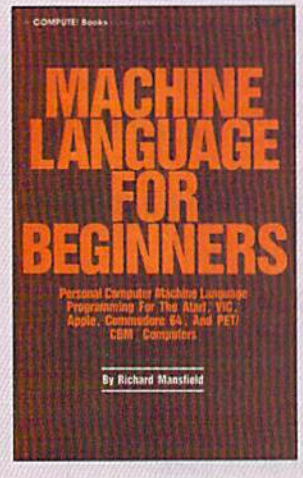
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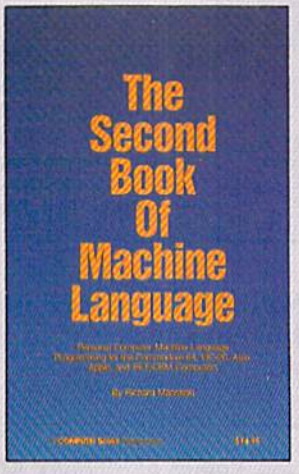

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Translator, a program which will convert program text files from *SpeedScript, PaperClip, Fontmaster I, Script 64, Easy-Script, Fleet System II, Creative Writer,* and *Omniwriter*. Sequential text files can be loaded with a GET command from the Disk Command screen. Finally, this 80-page manual is not without a touch of humor: The index informs us that "the meaning of life" is to be found on page 92.

Personally, I consider *Fontmaster II* at its $49.95 list price to be a terrific value, and well worth the trouble of learning some new commands in exchange for the excellent printouts it delivers. I would recommend it to anyone with a need to print high-quality documents with a dot-matrix printer, write easily in a foreign language, or design spectacular resumes and letterheads without a trip to the typesetter. I've found that Xetec provides excellent support for its programs, and I would not be surprised to learn that some provision is forthcoming for upgrading to the announced 128 version planned for release in several months.

—*Richard H. Eldridge*

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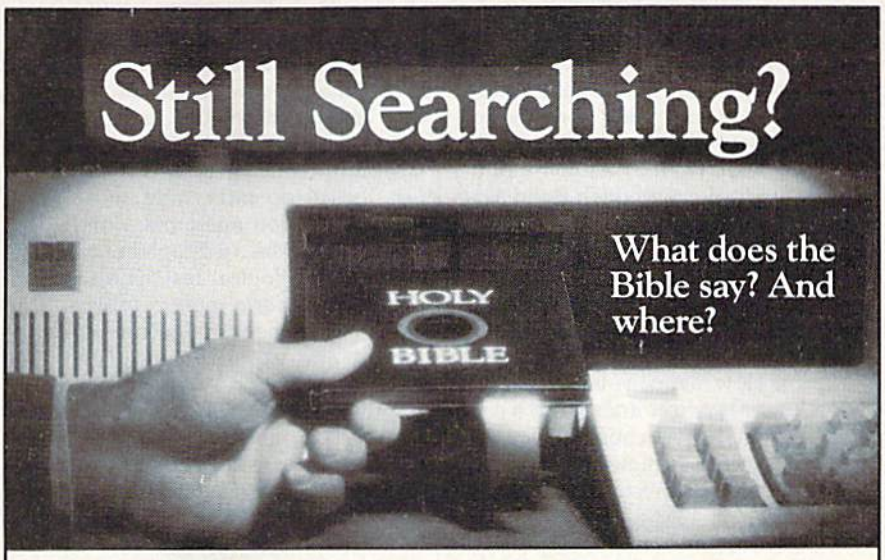
Vizastar 128

There's nothing quite like *Vizastar 128* for the Commodore 128: a powerful and flexible integrated spreadsheet, database, and graphics program.

Each application, if available separately, would be a good solid program. Together they offer the home and small business user a unique and powerful planning and reporting tool whose capabilities offer the maximum in flexibility. For instance, a salesman could set up an invoice form on his spreadsheet, include formula cells within the form to automatically calculate amounts, and produce invoices by drawing relevant portions of his customer database into the invoice form. Once through with his invoices, he could produce a summary of sales for the month in graphic form. All of this is accomplished without switching between two or three different programs.

The *Vizastar 128* package comes with a disk and a cartridge to plug into the user port. Since the cartridge acts as the program's copy protection, the disk is unprotected and may be backed up using normal copy programs. Also included with the program is an excellent manual that, in extremely organized and detailed fashion, explains the program's commands and features. A brief tutorial booklet is also provided to get you quickly into the program. However,



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you can expect to make frequent use of the manual because of the nature and power of the integrated applications. Supplementing the manual and tutorial booklet, the *Vizastar* disk contains several very good example files to play with and learn from. And, you'll find a money-back offer in which Solid State Software will return your money within 30 days of the purchase if you're not satisfied.

The program autoboots in 80-column display. (*Vizastar* will not run in 40 columns.) Once the program is loaded (a bit slow here), you're presented with the spreadsheet matrix and a command bar on the first couple of lines. It's easy to execute commands: Just type the first letter of the command in the command bar.

The heart of *Vizastar* is its powerful spreadsheet, boasting 64,000 cells (64 columns by 1,000 rows) and 60K of memory space. All spreadsheet commands and functions are performed within the spreadsheet matrix, including the setting up and printing of reports. The spreadsheet offers flexibility, power, and control over its application, plus the ability to adjust the layout of the matrix and to customize screen colors. Each column of the matrix can be adjusted from 3 to 75 characters in width. Up to 120 characters can be entered in each cell, and while not all can be displayed on your screen, they will print out correctly. Individual cells can contain text, a number, or a formula, and can be formatted in eight different ways (left- or right-justified text, centered text, integer, currency, date, scientific, and general).

By using the SHEET command, you have access to word processing sub-commands that facilitate a faster layout setup and subsequent manipulation of your spreadsheet. These commands include copying, moving, and deleting any cell or range of cells, inserting a column or row, erasing cell contents, sorting a row or rows, and setting up screen windows (up to nine on one screen). The copying and moving commands permit transfer of cell contents from column to column, or from column to row and vice versa.

Vizastar makes what-if calculations simple and quick by employing an automatic recalculation function that you can switch off and on. This means that immediately after changing any cell contents, the entire spreadsheet is checked by the program—and all cells affected by the altered cell's contents or formula will be recalculated. For example, a salesman can change the number of product units sold and immediately see the impact made on his commissions. *Vizastar*, however, defaults to manual recalculation, since automatic recalculation after every change in a cell's contents would make the initial setup or large changes a slow process. *Vizastar* also has the ability to recalculate by row or column.

Vizastar can handle just about any calculation you may need. Besides the basic arithmetic operations, *Vizastar* offers logical operators and several advanced function operators. The logical operators can be used together to create a compound logical test. The function operators perform more complex operations. They include algebraic, trigonometric, and exponential calculations, maximum and minimum values, a rounding function, and true/false statements. Two function operations rarely included in spreadsheets are the calculation of dates and what *Vizastar* calls *table lookup*. The program permits you to calculate the number of days between two specific dates. This is particularly helpful in financial calculations where interest accrual on loans and interest yields on investments are tied to the calendar.

Table lookup permits a cell to search a portion of the spreadsheet for a particular value and reference cells by their positon relative to the found cell. For example, you could search for a 5 and get the value of the cell to the right and put that value into the cell that did the lookup. It's complicated, but very useful.

Printing from *Vizastar*'s spreadsheet may be done in a number of ways. High-resolution screen dumps can be made with an Epson or compatible printer. Normal screen dumps are available for any printer. Custom reports can be printed to virtually any type of printer using the PRINT command. The OPTIONS sub-command permits you to identify a number of printing options, such as printer type, page length, lines per page, headers, footers, margins, and the range of cells to be printed. Additionally, *Vizastar* allows you to take advantage of your printer's special abilities. Once selected, your choices remain in effect during the current work session and are saved to disk with the spreadsheet file.

Because you start from scratch when you create a report layout, it takes a few minutes to set up. The program's flexibility, however, permits construction of just about any report layout you might need and incorporates sophisticated word processing printing features like text enhancements and different character sizes. *Vizastar* is also compatible with programs like *Sideways* which allow you to print (with dot-matrix printers only) a spreadsheet wider than 80 characters.

Vizastar provides extensive file and disk manipulation abilities, including the ability to merge two disk files. This lets you combine spreadsheets. You can list the disk directory onto the spreadsheet matrix, allowing you to print, annotate, sort, and save directory information. Word processing files—including those from *Vizawrite*, *Paperclip*, and *WordPro*—can also be brought onto the spreadsheet matrix. *Vizastar* also allows the loading of sequential Commodore ASCII files, so sequential files created by BASIC, or word processing files like *Easy Script* or *SuperScript*, can be loaded into the spreadsheet matrix. Finally, *Vizastar* offers disk maintenance commands such as erase and format, and permits the use of DOS commands from within the program.

Vizastar's most powerful feature is its macro-command system named Execution Lists, or Execs for short. Execs are miniprograms used to simplify some of *Vizastar*'s more complex features. As indicated earlier, printing a custom report can involve the use of many word processing features—such as headers and footers—and can draw upon information contained in both a spreadsheet and database file, making the generation of the report a tedious chore. Creating an Exec to do your report takes a few minutes, but once you create it, you can save it. Subsequent reports are printed by pressing F8.

Vizastar's database is as powerful as its sister application, the spreadsheet. The database's power and flexibility, combined with its ability to interact with the spreadsheet, make the database an especially attractive application for small business use. Up to 120 databases can be stored on a disk, each having up to 15 separate files. Each file can contain up to 1200 records (on a 1541 disk drive), and each record can contain as many as 8000 characters (120 characters per field) that can be displayed on up to nine screens per record and divided among 64 fields.

The design of *Vizastar* forces access to the database through the spreadsheet. This allows you to take advantage of the interaction available between the spreadsheet and the database, but appears foreign and awkward to someone used to a stand-alone database.

To access a database, you activate the DATA command on the menu bar. You are then presented with a sub-command menu allowing access to a database file, the creation of a new database, the transferal of information between the database and the spreadsheet, and the printing of selected information or reports.

Creating a database on *Vizastar* is both fun and quick. If you issue the USE and DATABASE sub-commands without identifying an existing database, *Vizastar* assumes that you want to create a new database. After naming the database and the file to be created (remember you can have up to 15

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different files in your database), you are presented with a screen to create your file layout. From here, you can paint or highlight using the character and color of your choice. Fields can be preceded by text and can be formatted with the same options as spreadsheet cells explained earlier. Once you've finished creating a maximum of nine layout screens for each record, you can save the layout to disk. You're now ready to begin entering information. If the screen layout needs to be altered, you can freely move fields within the screen and otherwise alter the layout by using the SETUP subcommand. Anyone who has set up a database and loaded in a lot of information, only to discover that the layout needs restructuring or an additional field needs to be inserted, will appreciate this feature.

Each field in your layout is identified by a one- or two-letter code from *A* to *BL*. These codes correspond to the 64 columns of the spreadsheet matrix and permit the movement of information between the spreadsheet and the database. Additionally, each field can contain a formula, which can include any of the operators available from within the spreadsheet. Not only can formula fields be used to show the results of other fields within the database, but they also can directly or indirectly reference the spreadsheet.

Once having identified the desired file to *Vizastar*, access to the database is easy. By using the ACCESS command, you can "leaf" through the records of your file, and add, replace, and delete fields or whole records. *Vizastar* employs a key-field system to organize records. The key field of a record is the field identified with the code *A*. Instant access to any record can be had if the key field is known. Broader searches can be accomplished using the CRITERIA subcommand. With this you employ a portion of the spreadsheet matrix to define the search criteria. The criteria used for the search would be placed in a cell in the spreadsheet corresponding to the field. For instance, if you wanted to find all persons whose last name is Smith that live in Denver, and field A contained the names of the persons in the database file and field B contained the name of the city where those persons lived, you would identify two cells in the spreadsheet matrix as the *criteria range*. Those two cells would be columns A and B of any unused row.

As mentioned, *Vizastar* makes it easy to transfer data between a spreadsheet and database file. The database is also equipped to export and import information to and from other programs. You can send database file data to a standard Commodore ASCII sequential file, and vice versa.

Last but not least, *Vizastar* produces some outstanding graphs. Using a high-resolution display, *Vizastar* can produce great-looking bar, multibar, and pie graphs using information from either the spreadsheet, database records, or both. The multibar and pie graphs employ color graphics and are extremely clear. I was most impressed with the multibar graphs, which can be expanded from display screen size to a full 8½ × 11 page size. Multibar graphs are intentionally drawn slowly for effect, but can be drawn instantly if you hold down the SHIFT key.

Graphs are drawn directly on the spreadsheet matrix, and by designating a window on the screen, you can display the graph while retaining a portion of the spreadsheet's text and figures. If recalculation of spreadsheet cells is in the automatic mode, a bar graph will be automatically redrawn upon the alteration of cells that constitute part of the graph. Labeling is available. Finally, a bar graph can be saved with a spreadsheet file, and when the file is recalled, the graph will be redisplayed.

Vizastar permits printing of any of the graphs it can generate, but apparently only supports Commodore and Epson or compatible dot-matrix printers. I did not have the opportunity to print out a multibar graph in color, but a black and white print of a graph on my Epson printer had exceptional clarity.

In summary, *Vizastar 128* is a gem of a program, with enough power and flexibility to satisfy even the most demanding home and small-business user. Its shortcomings (if one can call them that) arise from the program's complexity. Kelvin Lacy has written an intelligent program that takes as much of the drudgery out of spreadsheet and database applications as could be expected. The 64 version of *Vizastar* has been compared to *Lotus 1-2-3* for IBM computers, which is stretching things a bit. However, if you use or have used *Lotus 1-2-3*, and are looking for something comparable for your Commodore, *Vizastar 128* is as close as it comes.

—Scott Thomas

Solid State Software
1125 East Hillsdale Blvd.
Suite 104
Foster City, CA 94404
$119.97

Nam

Drained of its enormous political implications, the war in Vietnam makes for an interesting military study. The differences between the two armies are fascinating, as the guerilla-trained Vietcong takes on the more conventionally trained U.S. troops. Equally interesting is the problem of mounting a battle in the middle of a jungle. On a small-unit level, where politics does not enter, the fighting can be examined on its own terms.

To judge from SSI's *Nam* game for the Commodore 64, fighting in Vietnam was both confusing and deadly. *Nam* is a one-player game, with the player controlling the U.S. forces. The computer takes care of the Vietcong troops, and a formidable opponent it is. True to the nature of Vietnam conflicts, the VC are hidden until they move, fire, or are hit by fire—and just when you think you've found them, they disappear again, only to emerge wherever you don't expect them. *Nam* re-creates the U.S. troops' sense of impending ambush.

The attractive map is divided into small squares, each representing 50 meters of terrain. The map scrolls to provide a large playing surface, and both U.S. and Vietcong forces may be scattered about in various locations. In most scenarios, the dominant terrain is jungle. The game portrays, simply and effectively, how immensely difficult it is to fight an enemy that uses jungle as its defensive terrain. This is cautious, plodding fighting, where positions are hit one by one and sheer numbers do not always win.

As in most SSI war games, play is divided into phases. The Observation Phase allows you to examine the status of your units and to have them "dig in" for the best possible defense. In the Artillery Plot Phase, you aim your off-map artillery at likely targets. In following phases, the enemy fires and moves, and then your own units may fire at enemy units they can see. Next, you move your units, suffer enemy fire, and fire offensively one more time. After this, the plotted artillery fire falls roughly where you ordered it—even if your own troops now occupy the spot. In the Victory Phase, you receive points for units you have eliminated. Your current progress is then displayed on the screen.

The game includes six scenarios, each with variants for play flexibility. The first re-creates the Suoi Cat ambush of December 1966, demonstrating the battle's quick buildup. Ap Bau Bang is based on the March 1967 U.S. effort known as Operation Junction. In the third scenario, Ia Drang, you command the Air Cavalry in a clearing operation, while scenario four, Tuy Hoa, demands that you clear the underground caves of enemy forces. Two somewhat different scenarios are Ben Het, which simulates the March 1969 armor battle, and Hue, in which you fight to clear the city of entrenched and deadly VC snipers and troops. After the jungle of the previous scenarios, the city looks inviting, but taking it is tough.

With the game's functions under joystick control, *Nam* is a fairly easy game to play. It is detailed, but not overwhelmingly so; and its lack of focus on troop morale, which would seem a must for a Vietnam simulation, is more than made up for by the rigors of finding, engaging, and destroying the enemy. If you want a war game that does not require a huge commitment of time, that teaches you something about an interesting war, and that can be played without spending an hour or more ingesting rules, *Nam* is probably for you. If you are new to computer war gaming, *Nam* provides a good start. It's a solid product.

—*Neil Randall*

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Ultimate Wizard

In the race for better and better computer games, some software designers seem to have moved away from the quick-reflex action games that did so much to launch the personal computer industry and the Commodore 64. But one point may be lost in this movement: Arcade games can be a lot of fun. *Ultimate Wizard* is one such game. Like most arcade games, its line of descent is clear, from *Donkey Kong* through *Jumpman* through *Lode Runner*. In fact, part of its charm is its instant playability: Just load it, watch the prompts, and start playing. The instructions are short and mostly unnecessary, as arcade instructions should be. In the Commodore 64 version, the instructions can be read as the game is loading.

In *Ultimate Wizard*, you control a small wizard, who jumps and climbs his way through the dungeons of Kaytel. Each dungeon occupies one screen, with treasures you must pick up and dangers you must avoid. The object in all the dungeons is to find a key and take it to the keyhole. Once you do this, you enter the next dungeon. By collecting as many treasures as possible and getting through the dungeon quickly, you gain additional points. It's not necessary, unlike some games, to collect all the treasures before leaving the current dungeon. Finding the key, however, often depends on collecting specific treasures.

The opening screen allows you to opt for a demonstration, playing the game, or creating your own screen. For some reason, the designers have elected to allow you only ten seconds to make the choice, which means that if your joystick is plugged into the wrong port, you have a race on your hands. Once past this screen, the program has no other annoyances. The next screen allows you to choose your level of play, from Beginner through Expert, or it will randomize the dungeons for you. You then select the number of players and the speed at which everything moves. Slow speed at the Beginner's level is excruciating; high speed at the Expert level is, for me, impossible.

An option that *Ultimate Wizard* does not have, but which I have seen in no arcade games outside the old Atari 2600, is handicapping. Why is it not possible for each player to select unique beginning levels and speeds? I mention this because *Ultimate Wizard* has become a favorite with the neighborhood youngsters, and playing ability varies greatly. If all the kids could select their own starting point, play would be fair. This problem is not unique to this game, but it seems to be something that should have been addressed.

Where *Ultimate Wizard* shines, though, is in its variety of play and its use of graphics and sound. Each dungeon is different, with its own peculiarities and its own challenges. Each demands its own strategy and its own types of skills. And the entire game is filled with interesting and charming sound effects. Bells, whistles, pops, cracks, explosions, music: Every second of the game is accompanied by some kind of sound. The sounds very effectively lend the atmosphere of strangeness and mystery so necessary to the dungeon setting.

The game contains 100 levels. So far I've managed to master about 20, with some occasional successes at higher levels. And this is after many hours of play. *Ultimate Wizard* also contains a detailed construction set, which allows you to create your own levels. Anything the original 100 levels can do, you can recreate in the construction set. Creating a dungeon takes a fair bit of time, especially when you're learning, but for those who tire of the original dungeons, the process makes the game endlessly playable.

For me, though, the original 100 are plenty, at least for now. They give me enough treasures, enough monsters, enough impossible leaps and climbs to last me for a long time to come. Somewhere, I suppose, someone will finish the 100th level, read this review, and say, "What's he talking about? This isn't so hard." If that happens, and if the person is under 20 years of age, do me a favor. Don't tell me. I don't want to know.

—*Neil Randall*

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simple answers to common questions

Tom R. Halfhill, Staff Editor

Each month, COMPUTE!'s GAZETTE *tackles some questions commonly asked by Commodore users. If you have a question you'd like to see answered here, send it to this column, c/o* COMPUTE!'s GAZETTE, *P.O. Box 5406, Greensboro, NC 27403.*

Note to Readers: In the October 1986 "Simple Answers to Common Questions," a reader asked about changing a disk name without reformatting the disk. We answered that there's no easy way to do this and suggested two methods—neither very convenient: either use a disk-editing utility, or format a new disk with the desired name and copy all of the files.

Evidently this is a much more common question than we thought. We were soon deluged with letters offering simpler answers. In fact, we received more mail on this question than on any other topic in the 3½-year history of "Simple Answers to Common Questions."

Numerous readers enclosed various programs to change the disk name. We can't print them, however, because the senders usually weren't sure if the programs were copyrighted or in the public domain. Also, some of the programs were quite lengthy.

Fortunately, several readers—including R. F. Nevin, Pat McConville, Charles Springer, Robert B. Slota, Jason MacNeil, and Diana Shaffer—pointed out that the solution has already been published in the July 1985 issue of COMPUTE!'s GAZETTE. That issue's Power BASIC feature, "Disk Title Changer" by Michael Broussard, solves the problem with an efficient little program that's only eight lines long. You'll find it listed below.

Another reader, John T. Livingston, referred us to "Disk Tricks" by Gerald E. Sanders in the September 1984 issue. This article explains in detail how Commodore 1540/1541 disks are organized and provides four programs for modifying disks—including one that changes a disk name.

Incidentally, another program in "Disk Tricks" is designed to change the disk's ID as well. Once you format a disk, however, its two-character ID is permanent and cannot be changed without reformatting. The "Disk Tricks" program changes the ID listed on the directory, but it's merely a cosmetic change. Since we're frequently asked about changing disk IDs, we'll repeat: *The disk ID cannot be changed without reformatting the disk.*

Bernard A. Sobel brought to our attention a program called "Disk Surgeon" in *COMPUTE!'s Third Book of Commodore 64.* "Disk Surgeon" is a consolidation of the four programs by Gerald E. Sanders in the "Disk Tricks" article.

Finally, Gary A. Mohr mentioned a program called "Header Change" included on the 1571 Test/Demo disk that comes with every 1571 disk drive. It's three times as long as "Disk Title Changer," but it gets the job done.

We also received the following letter offering advice to the reader who recently acquired a VIC-20 computer, but lacked hardware and software ("Simple Answers," September 1986):

First off, many Toys "R" Us outlets still have VIC software on cartridges. Mostly games, but I have picked up an expansion board there and a 16K [memory] cartridge. If he has more than one Toys "R" Us in his area and checks them all, he might come up with some interesting items.

Next is K mart. They sold the VIC longer than anyone except Toys "R" Us, and there is usually still something on the shelf. (For you Timex/Sinclair 1000 owners, this is a good source, too.) I managed to find an RS-232 interface at a K mart.

For software, write to the following addresses: The Public Domain Software Copying Company, 33 Gold Street, New York, MY 10038; and the National Software Lending Library, 507 Race Street, Cambridge, MD 21613. The Public Domain Software Company sells software on disks, but it can be easily copied to tape. The price is nominal. The National Software Lending Library charges a lending fee, but they have both tapes and disks. They have games, utilities, productivity software, etc.

These are the best sources I have found, but don't discount the local user group. These people probably started with a VIC-20 and may have all kinds of software just lying about. Don't forget that Commodore sold millions of these machines, and they're still out there somewhere. I watch the used merchandise ads in the local papers, and in two years I've only seen maybe a half-dozen VICs for sale. Try these sources and keep looking. You'll be sure to find more.

Peter D. Eikenberry

Our thanks to the many readers who wrote with helpful suggestions.

Disk Title Changer

```
SX 10 CLOSE15:OPEN15,8,15:PRIN
      T#15,"I0:":CLOSE5:OPEN5,
      8,5,"#":B$=""
QQ 20 PRINT#15,"U1:5,0,18,0":P
      RINT#15,"B-P:5,144"
HJ 30 FORJ=1TO16:GET#5,A$:A$=C
      HR$(ASC(A$+CHR$(0))):B$=
      B$+A$:NEXT
ER 40 PRINT:PRINT"DISK NAME: "
      ;B$
EA 50 INPUT" NEW NAME";N$:IFLE
      N(N$)>16THENPRINT"MAXIMU
      M LENGTH IS 16":GOTO40
DS 60 IFLEN(N$)<16THENN$=N$+CH
      R$(160):GOTO60
PM 70 PRINT#15,"B-P:5,144":PRI
      NT#5,N$;:PRINT#15,"U2:5,
      0,18,0":CLOSE5
PP 80 INPUT#15,ER,ER$:PRINT"DI
      SK STATUS:"ER;ER$:PRINT#
      15,"I0":CLOSE15:END
```

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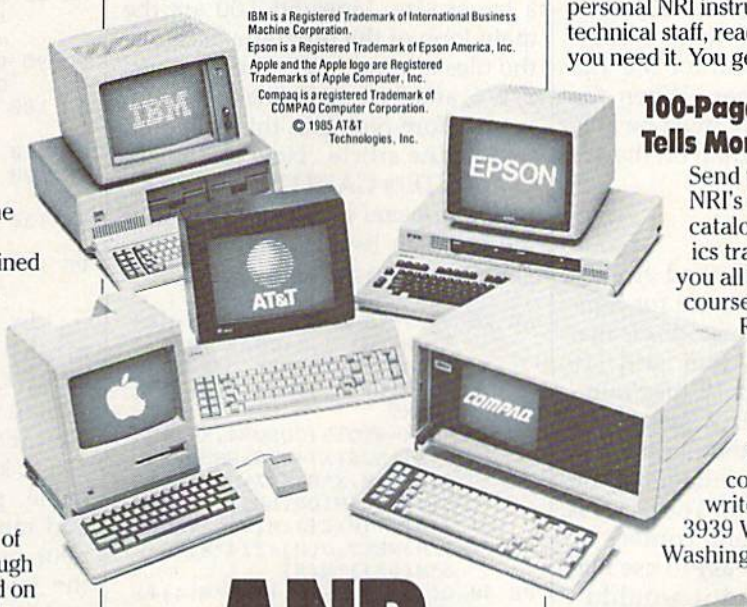

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Todd Heimarck
Assistant Editor

People say that the 128's BASIC 7.0 has scads of useful commands. Just how powerful is BASIC 7.0? Let's pose a challenge: to write a complete working program for the 128 that fits on one screen. When the program is listed, you must be able to see the entire program on the 40-column screen.

Sliding Numbers

The first game is derived from a puzzle that's been around for hundreds of years. The basic idea is that you have a four-by-four grid (16 spaces) that contains 15 tiles numbered 1–15, plus a blank space. The grid starts out with the numbers in order (1–4 on the top line, 5–8 on the second, and so on). The space is in the lower right-hand corner.

It would be too easy to use regular characters, and it wouldn't look very interesting to put a tiny four-by-four grid on the regular text screen, so the program prints large characters on the hi-res screen. This is a computer game, so the tiles are labeled in hexadecimal. The letters *A–F* replace the numbers 10–15.

A word of warning to anyone who types this in: Lines 30 and 100 are four lines long. You must type them without any spaces at all. After typing line 30, cursor back to the line before pressing RETURN. The program does fit on one screen, but the READY prompt pushes the top line off the screen. To see the whole program, press ESC and then M to turn off scrolling.

The hi-res GSHAPE and SSHAPE commands are the key to moving the large characters. After drawing a shape on the hi-res screen, you can save a portion of it into a variable with SSHAPE (see line 30). Later, you can rubber-stamp the shape anywhere on the screen with GSHAPE.

The CHAR command in line 20 puts the characters "123456789 ABCDEF " on the hi-res screen. Line 30 SSHAPEs them into a string array. Several calculations (lines 30–60) expand the shapes to a larger size. Lines 80–100 are the main loop of the program. To move the tiles around, press the numbers 2, 4, 6, and 8 on the numeric keypad.

(Before typing in this program, refer to the article "How to Type In COMPUTE!'s GAZETTE Programs," which appears at the beginning of the program listings section.)

```
EE 10 FAST:DIMNC$(15),LC(15,1)
      :Z$=CHR$(0)
AR 20 FORJ=1TO9:NL$=NL$+Z$:NEX
      T:GRAPHIC1,1:CHAR1,0,0,"
      123456789ABCDEF ":FORJ=0
      TO15:LC(J,0)=J:LC(J,1)=J
      :NEXT
AD 30 FORX=0TO15:COLOR4,X+1:NC
      $(X)=NC$(X)+NL$:SSHAPELH
      $,X*8,0,X*8+7,7:FORY=1TO
      8:V=ASC(MID$(LH$,Y)):FOR
      J=0TO7:P=2↑J:M(J)=(VANDP
      )/P:NEXT:C(0)=224*M(7)+2
      8*M(6)+3*M(5)
PE 40 C(1)=128*M(5)+112*M(4)+1
      4*M(3)+M(2)
XQ 50 C(2)=192*M(2)+56*M(1)+7*
      M(0)
KG 60 FORJ=0TO1:FORK=0TO2:NC$(
      X)=NC$(X)+CHR$(C(K)):NEX
      TK,J,Y:NC$(X)=NC$(X)+NL$
      +CHR$(23)+Z$+CHR$(21)+Z$
      :NEXT:SLOW:SCNCLR
MC 70 FORJ=0TO15:QY=(JAND12)/4
      :QX=JAND3:GOSUB110:NEXT
HJ 80 CF=LC(15,0):RX=CFAND3:RY
      =INT(CF/4)
QX 90 GETKEYM:NX=RX+(M=6)-(M=4
      ):NY=RY+(M=2)-(M=8):IF(N
      XAND4)OR(NYAND4)THEN80
HR 100 NL=NX+NY*4:CT=LC(NL,1):
       LC(CT,0)=CF:LC(15,0)=NL
       :LC(CF,1)=CT:LC(NL,1)=1
       5:QX=NLAND3:QY=INT(NL/4
       ):J=15:GOSUB110:QX=CFAN
       D3:QY=INT(CF/4):J=CT:GO
       SUB110:GOTO80
FG 110 GSHAPENC$(J),QX*24+116,
       QY*21+56,XOR((JAND4)/4,
       JAND1):RETURN
```

Auto Race

The next program is even shorter and easily fits on one screen.

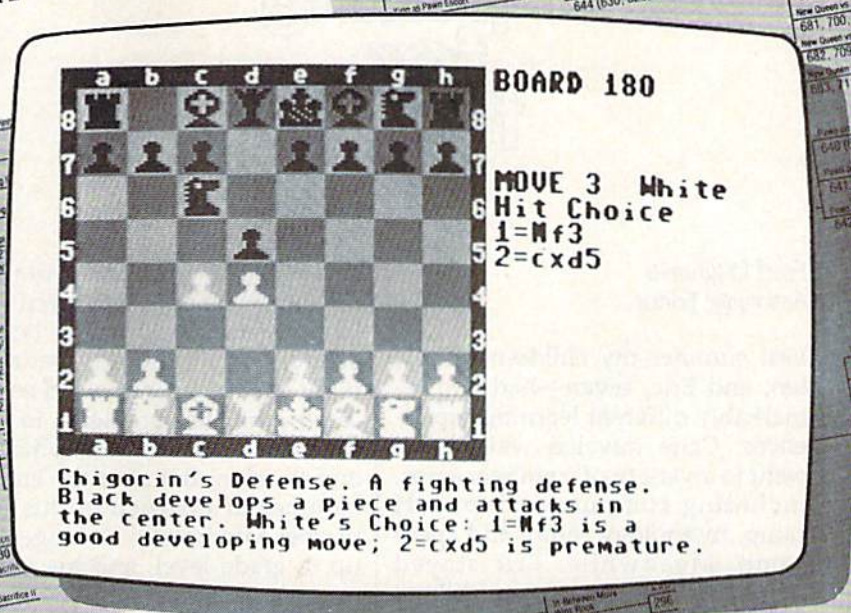
```
SF 10 R=RND(-TI/91):TRAP130:SC
      NCLR:COLLISION2,140
JF 20 TR$="*{14 SPACES}*":P=10
      :D=0
FX 30 SD$=CHR$(19)+CHR$(27)+"W
      "
HA 40 BLOAD"CARSHAPE",B0
ME 50 MOVSPR 1,160,180:SPRITE1
      ,1,2
BA 60 PRINTSD$;TAB(P);TR$;
EE 70 R=RND(1):IFR<.1THEND=INT
      (RND(1)*3)-1
XX 80 P=P+D:IF P<0 THENP=0:D=1
      :ELSE IFP>23 THEN P=23:D
      =-1
PQ 90 PL=JOY(2)AND127:MR=INT(J
      OY(2)/128)+1
AS 100 X=(0-3*(PL<5ANDPL>1)+3*
       (PL<9ANDPL>5))*MR
CB 110 MOVSPR1,+X,+0
PK 120 PT=PT+2:CHAR1,0,23,STR$
       (PT):GOTO60
RS 130 SCNCLR:SPRITE1,0:PRINTE
       RR$(ER)"IN"EL:STOP
PK 140 PRINT"{BELL}";:PT=PT-10
       :RETURN
```

In line 140, PRINT"{BELL}" might cause some confusion. CTRL-G makes a bell sound on the 128, so when you get to the {BELL} character, hold down the CONTROL key and press G. To play the game, plug a joystick into port 2 and move it left and right to keep your car on the road. Hold down the joystick button to move back and forth more quickly. The points gradually accumulate unless you hit the edge of the highway, in which case you lose a lot of points in a hurry.

If you type in and run the program, you'll probably get a FILE NOT FOUND error in line 40. Before you can use this program, you must design a car sprite. First type SPRDEF to enter the built-in sprite editor, and when you're asked for a sprite number, enter the number 1. After designing the shape, press SHIFT–RETURN followed by RETURN to exit the sprite utility program. Before proceeding, enter this line in immediate mode: **BSAVE "CARSHAPE", B0, P3584 TO P3647.**

Line 60 takes care of the scrolling. The SD$ string ({HOME} followed by ESC-W) scrolls the screen down a line at a time. The COLLISION statement in line 10 makes the subroutine at line 140 automatically execute whenever the car hits a wall.

At Last! A Chess Program that's On YOUR Side!


BOARD 180
MOVE 3 White
Hit Choice
1=Nf3
2=cxd5
Chigorin's Defense. A fighting defense. Black develops a piece and attacks in the center. White's Choice: 1=Nf3 is a good developing move; 2=cxd5 is premature.

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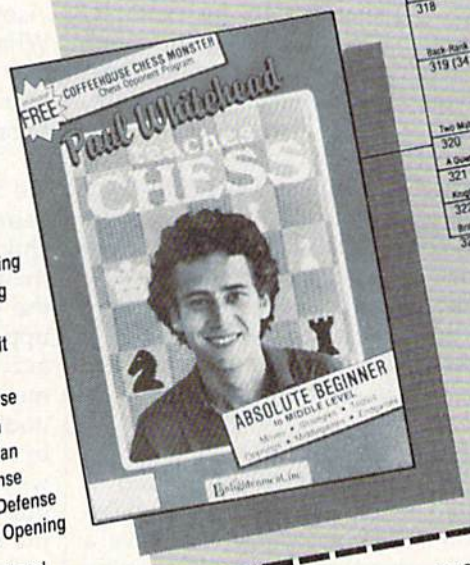

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The Roots Of Learning

Fred D'Ignazio
Associate Editor

Last summer my children—Catie, ten, and Eric, seven—had two remarkably different learning experiences. Catie traveled widely and went to a variety of summer camps, including computer camp, 4-H camp, mythology camp, and space camp. Meanwhile, Eric stayed home and went to summer school to boost his reading and math skills.

Catie had a wonderful summer. Eric, in the words of his teachers, "cried a lot" and was "moody."

Looking at my children's summer experiences, I can't help noticing the contrast in the way they were expected to learn. Catie spent her summer learning new skills through real-world experiences and simulations. At space camp, for example, she spent an entire week "training" in astronomy, water survival, computers, robotics, engineering, math, and design—as if she were an astronaut. The week came to a climactic end when Catie and her Sun team went on a space shuttle mission. As Mission Specialist One, Catie put to work what she'd learned so she could bring the space shuttle back to earth. Catie's counselors took delight in throwing complications at the kids to see how they'd do.

Deadly Digraphs

While Catie was flying around in outer space, Eric was in a classroom. He was deemed to have a short attention span while being drilled in initial consonant sounds, long and short vowel sounds, diphthongs, digraphs, blends, addition facts, subtraction facts, and every other kind of numerical and grammatical abstraction.

My wife and I enrolled Eric in a summer school math course because we hoped it would be an ego boost. Eric was a slow reader, but he was a whiz in math. Before the summer, he had loved math so much that he asked for word problems at night instead of bedtime stories. In a darkened bedroom, night after night, he solved complicated multistep problems in addition, subtraction, multiplication, and division. But after the end of a summer of instruction, his math teacher said he was no longer even up to grade level, and his attitude toward math was only "fair."

What happened? Why was Catie's learning experience so much better than Eric's?

According to Margaret Donaldson, in her classic *Children's Minds* (Fontana paperbacks, 1978), Eric's summer instructors expected him to learn through *disembedded thinking*. Disembedded thinking is reasoning not supported by human sense. It is "isolated from the rest of existence. What you may judge to be important apart from it, what you may know to be true—these considerations are to be excluded."

Reading, writing, and arithmetic are formal systems—disembedded thinking—that are the "basics" children are supposed to master in their early years of school. They are the prerequisites for success in the upper grades and for later in life. Yet according to new child-development studies, "There can be little doubt...that when we set such store by disembedded modes of thought we make the pursuit of education in our society a difficult enterprise for the human mind—one which many minds refuse at an early stage."

Donaldson reveals the crux of this problem, both for Eric and for many other children when she writes: "You cannot master *any* formal system unless you have learned to take at least some steps beyond the bounds of human sense, and...the problem of helping children to begin to do this in the early stages of their schooling—or even earlier—has not been properly recognized and is not usually tackled in any adequate way.... Thus we end up with a small number of educational 'successes' and a dismayingly large crop of 'failures.' And the urgent question is: how can this be avoided?"

Embedded Thinking

There is a paradox here. In recent years, researchers have gathered increasing evidence that, in direct contradiction to the findings of Jean Piaget, children are capable of some formal, or operational, thinking at a very young age—perhaps as early as three or four. Then why can't children learn how to do math and learn to read and write more easily? The answer is that children have trouble learning when they are asked to *think about things which have no meaning.* The child's mind tries to make sense out of new information introduced by his or her teacher. However, if the information is not related to a child's body, senses, or real-world experience—if it has no meaning to the child—the child will have trouble learning it.

Does this mean we should send our children to camp all year long instead of to school? No. As Catie's father, I know only too well how expensive that would be. But we do have an alternative to camp that's much less expensive: computers. Computers can let children simulate real-world experiences right in the classroom. Companies like Sunburst, Springboard, Grolier, Learning Well, Scholastic, DesignWare, MindScape, The Learning Company, and Spinnaker offer programs that teach language arts and math in the context of an activity or story in which the child plays a meaningful role. Stories bring drama, relevance, and meaning to abstract systems like phonics and arithmetic facts. And they embed thinking in the real world—the child's world.

bug-swatter

• Some users had a problem trying to redefine the NO SCROLL key using "KeyDef" (August). The problem can be traced to line 50, where the array which stores the names of the keys is initialized. The array is one element too small to store all the possible values generated by the keyboard. To correct the problem, all occurrences of the value 86 in line 50 should be changed to 87. Also, the name of the NO SCROLL key must be added to the end of the data in line 70. Finally, the names of some of the keys are assigned incorrectly in line 60. To correct each of these problems, substitute these program lines in your copy of KeyDef:

```
50 FORI=0TO9:K(I)=PEEK(4096+I)
   :POKE4096+I,0:NEXT:TRAP 180
   :DIMK$(87):FORI=0TO87:READK
   $(I):NEXT
60 DATA INST/DEL,RETURN,CR RT/
   LT,F7,F1,F3,F5,CR DN/UP,3,W
   ,A,4,Z,S,E,,5,R,D,6,C,F,T,X
   ,7,Y,G,8,B,H,U,V,9,I,J,0,M,
   K,O,N,+,P,L,-,.,":",@,",",
   £,*,;
70 DATA CLR/HOME,,=,↑,/,1,←,,2
   ,SPACE,,Q,RUN/STOP,HELP,,5,
   TAB,2,4,7,1,ESC,+,-,LF,ENTE
   R,6,9,3,,0,.,CR UP,CR DN,CR
    LT,CR RT,NO SCROLL
```

• As listed, "Sound Designer for the 128" (July) will not save sounds. After attempting to save a sound, its name appears in the catalog of stored sounds, but if you try to load it, you'll see a FILE NOT FOUND ON THIS DISK message. To correct this problem, you must first fix Sound Designer's save routine by changing line 1590:

```
1590 OPEN15,8,15,"S0:"+FS$:GOS
   UB2080
```

Next, remove from the catalog file all sounds that were improperly saved using the original routine. Use the following lines to reset the catalog file. Type each line in immediate mode (without a line number) and press RETURN:

```
OPEN1,8,15,"S0:CATALOG":CLOSE1
DOPEN#1,"CATALOG",D0,U8,W:PRIN
   T#1,"**********":DCLOSE#1
```


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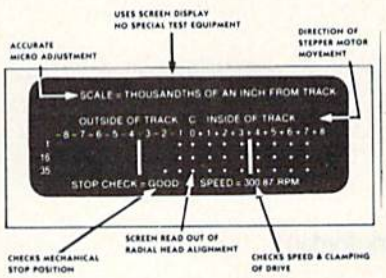

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Program Mis-Matcher

Mark Jordan

Programmers will appreciate this handy utility that compares two BASIC programs. Output is to screen or printer. For the Commodore 64, 128, Plus/4, or 16 with disk drive.

It happens often when you are programming: You want to know exactly how the program you're working on differs from a previously saved version. Or maybe you have two versions and you're not sure which one to load because you can't remember which is more recent—GAME2 or GAMEB. Maybe you've been doing some experimenting with an old program and like some of the changes you've made, but you don't like some others. Wouldn't it be helpful to compare the experimental version with the previous one to see which lines have been altered or added? "Program Mis-Matcher" helps out in situations like these. It compares two BASIC programs saved on disk.

Comparing

To use the program, Commodore 64 users should type in Program 1 as listed and save a copy on disk. Plus/4 and 16 users should type Program 1, but add or substitute the lines shown as Program 2. Now load the program and type RUN. The program asks for the names of two files. Type in the program names, pressing RETURN after each. Mis-Matcher will stop if it can't find the files on disk. The program then asks whether you want a listing of the differences to go to the printer. Press N to send the output to the screen only. The program assumes that the printer is connected as device 4. You'll need to change line 80 if you use some other configuration.

Commodore 128 owners can use the 64 version (Program 1). The program must be run in Commodore 64 mode, but it can be used to compare both BASIC 2.0 (Commodore 64) and BASIC 7.0 (Commodore 128) programs. One special restriction applies to comparing 128 programs if you have a 1571 disk drive: Both of the programs being compared must be on the front side of the disk. When used in conjunction with 128 mode, the 1571 can store data on both sides of the disk. Mis-Matcher will fail if either or both of the program files to be tested are on the second side. If they are, save both programs on a disk formatted while the drive is in 1541 mode (as when the computer is set for 64 mode). You can then use Mis-Matcher.

There are two ways in which one program may differ from another. First, one might have a line that's missing in the other. Second, the programs might have lines with the same line number which are not identical. Mis-Matcher recognizes and reports both kinds of differences.

Some assemblers, including the popular PAL for the 64, use the BASIC editor to enter source code. For such assemblers, Mis-Matcher can be used to compare two source-code files, so machine language programmers can also benefit from this tool.

See program listing on page 141.

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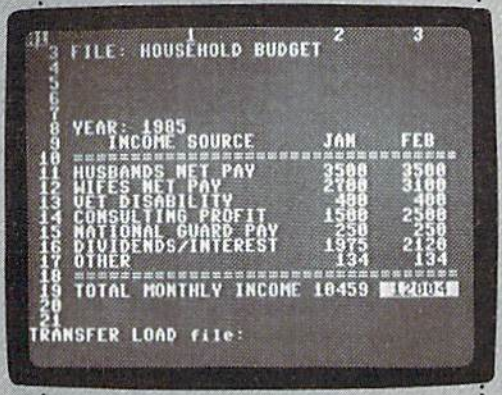

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Commodore 64 Database

A new database for the Commodore 64, *Fastfile*, offers up to 31 fields per record and up to 256 bytes per record. Marketed as significantly faster than other databases for the Commodore 64, *Fastfile* is a memory-based, menu-driven database written in machine language. This database includes predesigned forms for a checkbook, mailing lists and labels, inventory, and tax form 8283. You can also create your own forms, and there's a 28-page illustrated manual.

Fastfile costs $59.95, plus $4 shipping and handling. Foreign customers should add $2 and Washington residents add 7.3 percent. No C.O.D.'s. There is a 15-day money-back guarantee.

Interactive Mini Systems, 5312 W. Tucannon, Kennewick, WA 99336.

Circle Reader Service Number 202.

More From Lucasfilm

Lucasfilm Games, which entered the home computer entertainment market a couple of years ago with *Ballblazer* and *Rescue on Fractulus* from Epyx, has released a new game in conjunction with Activision Software. *Labyrinth: The Computer Game* is an animated graphic adventure for the Commodore 64. It's based on the recent film directed by Jim Henson.

In *Labyrinth*, the evil Goblin King has captured you and locked you inside his Labyrinth, a twisting, winding maze of paths and passageways that lead to his castle. Along the way, you'll meet many characters, some of whom will offer their assistance, and others who will do everything they can to keep you trapped inside the Labyrinth forever. You use a joystick to control your animated character through a variety of strange locations, such as the Bog of Eternal Stench, the Wise Man's Garden, the Hall of Stone Faces, and the Wall of Hands.

Suggested retail price is $34.95.

Activision, P.O. Box 7286, Mountain View, CA 94039.

Circle Reader Service Number 203.

New QuantumLink Features

QuantumLink, a Commodore-specific telecommunications service, has introduced several new features among its offerings.

One addition is a SIG (Special Interest Group) for users interested in *GEOS* (Graphics Environment Operating System), an icon- and menu-based software program that gives the Commodore 64 a user interface similar to that of the Macintosh. This SIG provides support through question-and-answer sessions with Berkeley Softworks, the publishers of *GEOS*; conferences to discuss *GEOS* applications; and news on the latest *GEOS* developments and software.

QuantumLink has also introduced an online photo gallery, which uses specialized equipment to convert subscriber photographs into computer programs. Each program is then placed in the gallery for other users to download and display. Finally, the service has added more discounted products and a live auction to its shopping section, as well as a new information and news section on rock music—RockLink.

Quantum Computer Services, 8620 Westwood Center Dr., Vienna, VA 22180.

Circle Reader Service Number 204.

Spreadsheet Package

A new spreadsheet and statistical package from Echo Lake Laboratories, *ELBE: The Echo Lake BASIC Enhancement*, has been introduced for the Commodore 64. The spreadsheet portion of *ELBE* is completely integrated into the computer's resident BASIC interpreter so the user can move back and forth between the computer's BASIC interpreter and the spreadsheet. The spreadsheet allows record-oriented data processing in BASIC and full and direct random access to disk files. It also can automatically right-adjust entries, line up decimal points, copy repeated data, and formulate a numeric keypad. *ELBE* lets you easily insert and delete records and sort the spreadsheet alphabetically or numerically.

ELBE also performs many of the traditional descriptive statistics such as computing median and mode, chi-squared tests, goodness-of-fit tests, analyses of variance and covariance, repeated-measures designs, mixed designs, correlation matrices, and multiple regressions. It can handle analysis of variance designs of up to 40 cells and some designs of over 200 cells. *ELBE* can even work with missing data and unequal cell sizes.

ELBE: The Echo Lake BASIC Enhancement is written in machine language. The program is copyrighted, but the disk is not copy-protected. A hardware key, which is provided with the software, is required to use *ELBE*.

Price is $49.95.

Echo Lake Laboratories, Box 169, Pasacoag, RI 02859-0169.

Circle Reader Service Number 205.

Hard Disk Drives

JCT has introduced three new hard disk drives for the Commodore 64 and 128. The JCT 1000, 1005, and 1010 contain 3.7, 5, and 10 megabytes of formatted capacity, respectively. All three disk drive packages feature an ST-506–compatible controller card, a Commodore-compatible interface card, interconnection cables, and a resident disk operating system. Each disk drive comes with power supply, A.C. power cord, fuse, fuse holder, and on/off switch.

Each package includes instructions for installation and operation, a five-year limited warranty on the drive, and a one-year warranty on all other hardware.

Suggested retail price for the JCT-1000 is $695, $795 for the JCT-1005, and $895 for the JCT-1010.

JCT, P.O. Box 286, Grants Pass, OR 97526.

Circle Reader Service Number 206.

Digital Sound Sampling

You can mix and store your own musical creations with Micro Arts' *Sampler-64* and *Com-Drum*. *Sampler-64* is a hardware/software package that lets you record, mix, add to, play back, and store any sounds on your Commodore 64 or 128 in 64 mode. It features a real-time input sequencer; echo, looping, and reverb effects; sample dubbing; sample block editing; and a two-octave range with the QWERTY keyboard.

The *Sampler-64* package includes a microphone, a cable to connect to your TV, and a ¼-inch jack to connect the sound output to an audio amplifier. The

hardware unit plugs into the user port of the Commodore 64 or 128. (The SID chip is not used in digital sound generation.) The menu-driven program comes on disk only and is not copy-protected.

Along with *Sampler-64*, you may wish to use *Com-Drum*, a software upgrade which adds three different eight-piece drum kits to your music. *Com-Drum* has a realtime sequencer for input and a step-time sequencer for editing. You can play up to three instruments simultaneously and store up to eight songs per disk. The prerecorded samplings feature Latin, rock, and miscellaneous drum kits.

Sampler-64 is sold for $89.95 plus $3.95 shipping and handling. *Com-Drum* costs $14.95 when bought with *Sampler-64* and $29.95 when bought alone. Both are sold by mail only. Pennsylvania residents must add 6 percent sales tax.

Micro Arts Products, P.O. Box 2522, Philadelphia, PA 19147.

Circle Reader Service Number 207.

Shakespeare On Disk

Macbeth, a new game from Avalon Hill, lets you take part in graphics-and-text adventures based on Shakespeare's tragedy, *Macbeth*. Four separate text adventures, two containing graphics, cover all the parts of the play. You can play the games as the young Macbeth, the older king defending his castle, Lady Macbeth plotting a murder, or the three witches preparing their famous brew.

Plus, each segment has a psychological program in which you try to discover what motivated the characters.

Macbeth includes the entire play from the 1623 *First Folio*, articles on the play, the play's history, and interpretations of characters.

Suggested retail price is $25 for the Commodore 64 and 128.

Avalon Hill Game Company, 4517 Harford Rd., Baltimore, MD 21214.

Circle Reader Service Number 208.

Make Your Commodore Talk

Hearsay has released a speech synthesizer/voice recognition add-on device and software packages that enable your Commodore 64 or 128 to talk and to respond to verbal commands. The Hearsay 1000 is a module that plugs into the rear port of the computer. It works with Hearsay software and many menu-driven third-party software packages already available.

The company has introduced a line of software for children, designed to help them learn basic skills on the computer through seeing and hearing. The Software for Children line includes *Rhyme and Reason*, a program which uses familiar nursery rhymes to teach

The Hearsay 1000 speech module for the Commodore 64 and 128.

the names of animals, names of clothing, parts of the body, seasons, safety, and other basics; *Aqua Circus*, which combines graphics, sound, and animation along with circus characters to teach shapes, colors, counting, numbers, and simple math; and *Think Bank*, a concentration game that helps the student learn addition, subtraction, multiplication, and division.

There's also a software program for adults. *Intelligent Talking Terminal* is a voice-activated telecommunications program. At your verbal command, the computer will automatically dial CompuServe, the police, or anyone else you designate. You can also view any information on the screen or print it out.

The Hearsay 1000 module retails for $79.95. Suggested retail price for *Rhyme and Reason, Aqua Circus, Think Bank*, or *Intelligent Talking Terminal* is $29.95 per program.

Hearsay, 1825 74th St., Brooklyn, NY 11204.

Circle Reader Service Number 209.

Database Manager For The Commodore 64/128

KnowledgeWare has announced a new text database manager for the Commodore 64 and 128. *Multifinder* comes with five applications—Refinder, for literature references; People and Places, a name, address, and mailing label file; Recipe Finder, for indexing recipes; Video Finder, for videocassettes; and Program Finder, to catalog software. You can also design your own applications.

The full-screen editor in *Multifinder* offers a field delete function, field memory which lets you display your previous entry, caps lock, and fast searching of up to four words or phrases. There is no fixed limit on the number of characters in a field, except that total characters in a record cannot exceed 248 in six fields. *Multifinder* holds up to 650 records on a disk.

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The 1040ST gives you all this for $999–which we think will be music to your ears.
Available at fine computer and music dealers.
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The active commands are displayed at the bottom of each screen display, and instructions are included with the program.

Multifinder will autoboot on the Commodore 128.

The price of *Multifinder* is $39.95. A demonstration disk is available for $2.

KnowledgeWare, 2013 N.E. 55th Blvd., Gainesville, FL 32601.

Circle Reader Service Number 210.

New IntelliCreations Games

IntelliCreations has announced two new games for the Commodore 64. *Gunslinger* is a graphics-and-text adventure game that takes place in the Old West. You are Kip Starr, the retired Texas Ranger, and you must rescue your friend, James Badland, from jail in a small Mexican town. On the way, you travel through a ghost town, explore a mine, battle hostile Indians, escape an enemy fort, and avoid the six Dalton Brothers who are out to get you. If you do finally rescue Badland, you still have to survive the confrontation with the Dalton Brothers at the OK Corral.

Gunslinger has a split-screen format with graphics in the upper left section, commands on the right, and text along the bottom of the screen. Play is controlled by either joystick or keyboard.

Theatre Europe is a war-simulation strategy game that deals with situations which could occur today or tomorrow, such as the first 30 days of a war in Europe between the Warsaw-Pact and NATO forces. You can command either the NATO forces or the Warsaw-Pact armies, which have invaded West Germany. The computer is the commander of the opposing forces. A map of Europe appears on the screen and you choose which battle you want to participate in.

There are three levels of play. Each higher level gives you less information and forces you to rely on your own strategy and expertise to avert war.

The retail price of *Theatre Europe* is $34.95; for *Gunslinger*, $29.95.

IntelliCreations, 19808 Nordhoff Place, Chatsworth, CA 91311.

Circle Reader Service Number 211.

Apple II+ Emulator For The 64

The Spartan from Mimic Systems lets you run more than 95 percent of all Apple II+ software on your Commodore 64. It's a flexible, bus-oriented microcomputer system which is closely coupled to the 64. In addition to letting you run Apple II+ software, the Spartan allows you to add a variety of Apple peripherals and options like 80-column display cards, music synthesizers, and Z-80 and CP/M cards.

The price of the Spartan is $299.

Mimic Systems, 18027 Highway 99, Building A, Suite I, Lynnwood, WA 98037.

Circle Reader Service Number 212.

The Spartan ($299) is an Apple II+ emulator for the Commodore 64.

Outline Processor

Thoughtform, a full-featured outline processor written in machine language for the Commodore 64, lets you enter ideas and facts in any order and then arranges your data into logical order. It can handle headlines nested 200 levels deep and can expand or collapse headlines as needed. You can print all or any portion of the outline, or send it to a sequential file to be read by a word processor.

Thoughtform is meant to be user-distributed software, which means that registered owners can give away copies. When one of the users decides to buy the software from Thoughtform, the owner who distributed it receives a commission.

Thoughtform costs $35, and there's a 30-day guarantee on the purchase price.

Thoughtform, 45828 Emerson St., Hemet, CA 92344.

Circle Reader Service Number 213.

I/O Card For Commodore

Intelligent I/O has announced the release of its newest version of the BH100 General Purpose Input/Output Card for the Commodore 64 and VIC-20 computers. The card provides a total of eight 8-bit parallel ports (32 digital input lines and 32 digital and buffered output lines).

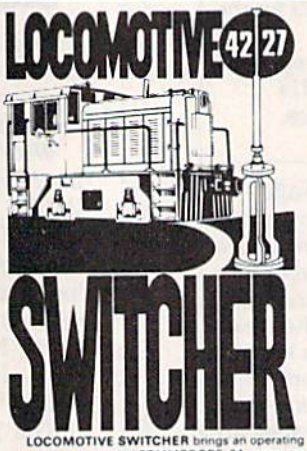
Since the ports are memory-mapped, data is sent or retrieved by the use of a single POKE or PEEK command. The BH100 manual includes instructions, sample programs (including simple subroutines for all I/O), and diagrams of typical hookups. And it's designed so that the user doesn't have to know any advanced programming techniques.

3 EXCITING COMPUTER SIMULATIONS from SIGNAL COMPUTER CONSULTANTS

Are available from SIGNAL COMPUTER CONSULTANTS, Ltd., P.O. Box 18222, Dept. 11, Pittsburgh, PA 15236, or call (412) 655-7727. US and Canada add $2.50 postage and handling ($4.00 foreign) for each game ordered. PA residents include sales tax. Use Master Card, VISA, moneyorders or checks drawn on US or Canada banks. Master Card and Visa show card number, expiration date and signature. We guarantee and support our products. Free replacement or full refund for 30 day warranty period. Dealer inquiries invited.

Created in response to feedback from users of the popular *TRAIN DISPATCHER* program, **SUPER DISPATCHER** is the most extensive CTC simulation on the market today for personal computers. Three completely different territories are provided along with new features such as fleeting, train reversing, control over clock speed, and complete randomization of dispatching situations. Programmed in assembly language, **SUPER DISPATCHER** provides for lightning-fast response to your commands as you route up to 60 trains over single, double and triple track territories.

Available for the Commodore 64 (disk only) at $35.00. Keyboard template and comprehensive instruction manual included.



LOCOMOTIVE SWITCHER brings an operating railroad layout to the COMMODORE 64 computer screen. The microlayout consists of mainline, six switches and seven loading areas. Sophisticated car-motion logic simulates train movements to a degree not possible on "real" model railroad layouts.

LOCOMOTIVE SWITCHER operates in two modes. As a FLAT YARD cars must be "spotted" at assigned loading docks – or pulled out to the mainline. In HUMP YARD mode the layout becomes a mini-classification yard. Operator performance is tracked and scored based on number of cars spotted, train moves, car damage and operating time.

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Complete system package includes: the Commodore 128 CPU with 128K (expandable to 512K), built-in Basic and 40/80 column display, the Commodore 1571, 5¼", disk drive featuring 350K capacity and built-in 6502 microprocessor, the Magnavox 8562 RGB/composite monitor with green text display switch...and ... diskettes with CP/M systems and utilities plus the 128 tutorial.

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This complete system package includes: the Commodore 64 CPU with 64K and four programable function keys and a music synthesizer, 3-D graphics capability and sixteen text colors, the 1541, 5¼", disk dive featuring 170K capacity and built-in 6502 microprocessor, the Taxan 220 composite color monitor with 14" screen, green and amber text modes and audio.

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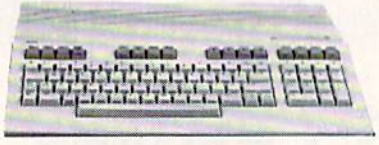

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The new 64 with the Commodore 128 look includes: GEOS, GEOWRITE, GEOPAINT, AND QUANTUM LINK software. Now you can get the world's most popular computer in the newest style cabinet!

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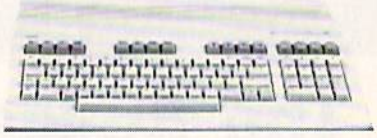

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The Commodore 128 is one of the most comprehensive computers on the market today. Its standard 128K of memory is expandable to an incredible 512K.

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The 1541 Disk Drive is an external 5¼'' floppy diskette recorder and player, offering high-speed and capacity for programs and data. It is an intelligent device, containing its own microprocessor, RAM, ROM, and operating systems software for faster speed of throughput and memory efficiency in the computer. It is read/write compatible with diskettes created on Commodore 4040 and 2031 disk drives. Interface cable for the Commodore 64 is included.

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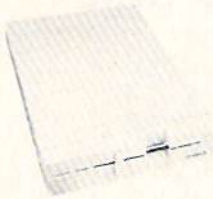

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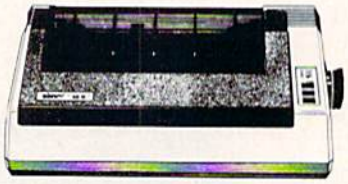

120 cps dot matrix for the Commodore 64 and 64C. Includes interface and cable.

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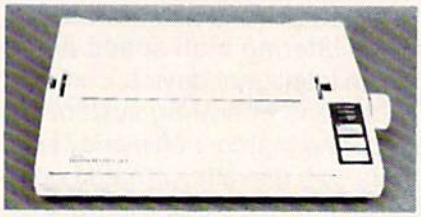

Features 100 cps and "select type". Choose NLQ, double strike, condensed or emphasized at the touch of a button.

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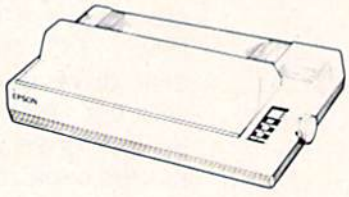

120 cps draft, 16 NLQ and "select type". Allows selection of NLQ, double strike, condensed and emphasized at the touch of a button.

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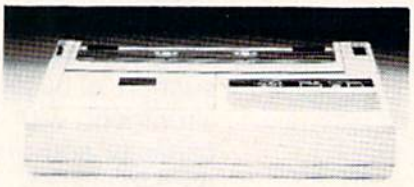

A thermal transfer printer featuring 60 cps. Uses black and white or color "clean hands" ribbons. Excellent for color graphics.

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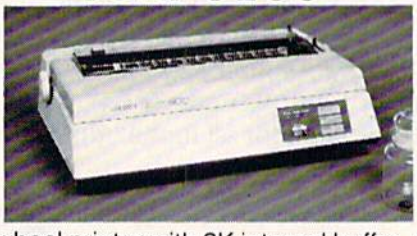

LQ daisywheel printer with 2K internal buffer, graphics capability, proportional spacing and the ability to print through 4 part forms.

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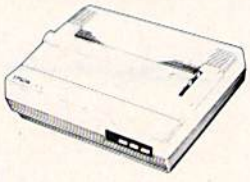

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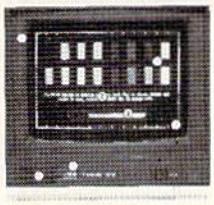

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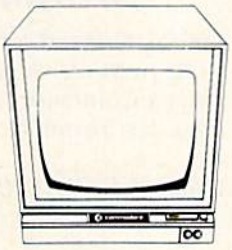
The Commodore 1802 composite monitor is the replacement for the 1702 monitor. It features 13'' screen, 40 col x 23 line display and audio.



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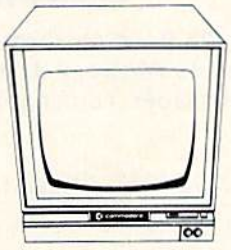

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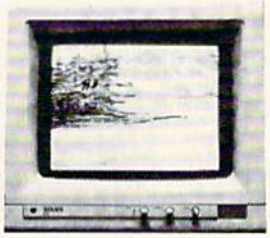

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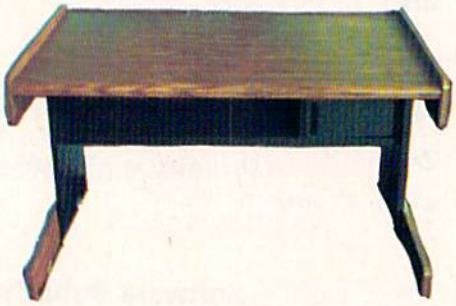

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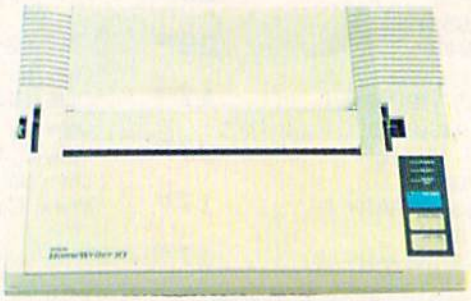

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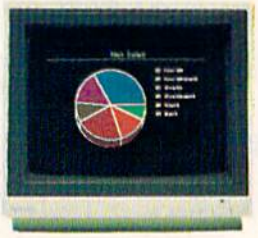

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The company is also introducing the Complete Beginner's I/O Interface Course, an introductory course on computer interfacing. The complete course retails for $159 and includes the BH100 I/O interface, a beginner's module, and an illustrated course manual. The manual can also be purchased separately for $15.

Intelligent I/O, P.O. Box 70, Potsdam, NY 13676.

Circle Reader Service Number 214.

Bulletin Board System Software

Blue Board, from SOTA Computing Systems, is a BBS program for the Commodore 64. It supports over 200 online messages (up to 1023 characters each), up to 220 users, and over 25 SYSOP-definable sub-boards. The software is written entirely in machine language and employs highly optimized disk driver routines, making it a very fast system.

Other features of the board include remote SYSOP access, a private SYSOP sub-board, and unlimited session connect time. Each of these features is password-protected for system security. *Blue Board* also features "scribbles," mini sub-boards where messages of 80 characters or less may be used for opinion forums, voting, chess games, or other applications. The system has been designed to provide the SYSOP with total system control. Suggested retail price is $69.95.

SOTA Computing Systems Ltd., 213-1080 Broughton St., Vancouver, B.C., Canada V6G 2A8.

Circle Reader Service Number 215.

New Commodore-Compatible Printer

Star Micronics has introduced the NX-10C Commodore-compatible printer, with NLQ (near-letter-quality) and draft modes. The printer connects directly to the Commodore 64 and 128 computers through a built-in Commodore serial interface. Speeds range from 120 characters per second (cps) for draft output to 30 cps for NLQ type.

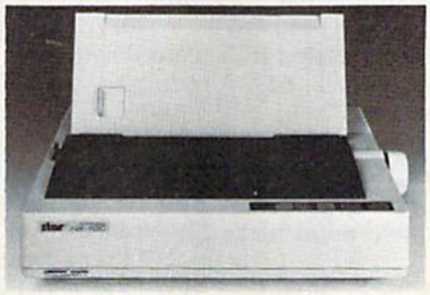
Front-panel controls on the NX-10C make the printer easier to use, and there's fingertip selection of draft or NLQ modes, typeface and print pitch, and margin settings and form alignment as well. Flipping the automatic-paper-feed lever feeds single sheets into position for printing on whatever line you designate. An adjustable rear tractor feed, as well as friction feed, are standard features that allow for either fanfold or cut-sheet paper printing. In addition, preprinted forms can be aligned by adjusting the forward and reverse micro feed.

The NX-10C has its own built-in character set, offering upper- and lowercase letters, numbers, and symbols in NLQ mode with the addition of block graphics in high-speed draft mode. Full Commodore MPS-803 emulation allows graphics to be integrated into the printing. The printer is bidirectional; also, logic seeking is a standard feature of the NX-10C. The printer comes with a snap-in ribbon cassette.

The suggested retail price for the NX-10C is $349.

Star Micronics, 200 Park Ave., Suite 3510, New York, NY 10166.

Circle Reader Service Number 216.



The Star Micronics NX-10C is a new Commodore-compatible dot-matrix printer.

General Ledger Program

Bookkeeper-64 from Datacount Software is a single-entry general ledger program for home or small business use. This software for the Commodore 64 incorporates a chart of accounts, transaction register, and income statement. The displays are menu-driven, and the reports can be printed out for permanent record.

Two additional programs are included in the package. *List-64* is a list processing program with up to ten fields in each file. *Biorhythm-64* produces a biorhythm chart and a list of critical days.

Bookkeeper-64 is available for $19.95 plus $2 shipping and handling. California residents should add 6% sales tax.

Datacount Software, P.O. Box 1679, Coronado, CA 92118.

Circle Reader Service Number 217.

SpeedScript Customization

Speedmate is a customization program for the *SpeedScript* word processor (versions 3.0–3.2) that lets you set the defaults you prefer and control the way text appears on the screen while editing. *Speedmate* includes an optional print preview routine which displays 80 columns of text onscreen at once with no horizontal scrolling. *Speedmate* also customizes COMPUTE!'s *Preview-80* control commands for one-hand operation. (*SpeedScript* and *Preview-80* are products of COMPUTE! Publications and are not included with *Speedmate*.)

The program lets you set and save defaults for right, left, top, and bottom margins; page length; spacing; continuous or single-sheet paper; first and starting page numbers; page width (for centering); and more than 35 predefined printer code defaults, as well as screen and letter colors, among other features.

Speedmate is available for $15 (outside US and Canada, add $2 per disk; North Carolina residents add 5% sales tax).

Upstart Publishing, Dept. NPGM, P.O. Box 22022, Greensboro, NC 27420.

Circle Reader Service Number 218.

128 Software From Abacus

Three new productivity software packages for the Commodore 128 are now available from Abacus. *SpeedTerm 128* is a flexible, command-driven terminal software package that supports most modems for the 128. It contains the standard options found in most terminal software; plus *SpeedTerm 128* supports Xmodem and Punter file-transfer protocols and VT52 and VT100 terminal emulation with cursor keys. It has a 45K capture buffer and user-definable function keys.

TAS-128 is a technical analysis system for stock market charting. With *TAS-128*, you can download indicators from DNJ/RS or Warner and then create a variety of charts on the split screen using seven moving averages, three oscillators, five volume indicators, comparison charts, trading bands, and least squares. It also has macro capabilities, automatic and unattended log-on, and fast draw charts using up to four windows.

Abacus has upgraded the *Personal Portfolio Manager* for the 128. *PPM-128* tracks the performance of stocks, bonds, options, or profits and losses. It also has very complete reporting capabilities.

SpeedTerm 1128, *TAS-128*, and *PPM-128* all retail for $59.95 each.

Abacus Software, 2201, Kalamazoo SE, P.O. Box 7211, Grand Rapids, MI 49510.

Circle Reader Service Number 219.

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COMPUTE!'s GAZETTE Author's Guide

Here are some suggestions which serve to improve the speed and accuracy of publication for prospective authors. COMPUTE!'s GAZETTE is primarily interested in new and timely articles on the Commodore 128, 64, Plus/4, and 16. We are much more concerned with the content of an article than with its style, but articles should as be clear and well-explained as possible.

The guidelines below will permit your good ideas and programs to be more easily edited and published:

1. The upper left corner of the first page should contain your name, address, telephone number, and the date of submission.

2. The following information should appear in the upper right corner of the first page. If your article is specifically directed to one model of computer, please state the model name. In addition, *please indicate the memory requirements of programs.*

3. The underlined title of the article should start about 2/3 of the way down the first page.

4. Following pages should be typed normally, except that in the upper right corner there should be an abbreviation of the title, your last name, and the page number. For example: Memory Map/Smith/2.

5. All lines within the text of the article must be double- or triple-spaced. A one-inch margin should be left at the right, left, top, and bottom of each page. No words should be divided at the ends of lines. And please do not justify. Leave the lines ragged.

6. Standard typing or computer paper should be used (no erasable, onionskin, or other thin paper) and typing should be on one side of the paper only (upper- and lowercase).

7. Sheets should be attached together with a paper clip. Staples should not be used.

8. If you are submitting more than one article, send each one in a separate mailer with its own tape or disk.

9. Short programs (under 20 lines) can easily be included within the text. Longer programs should be separate listings. *It is essential that we have a copy of the program, recorded twice, on a tape or disk.* If your article was written with a word processor, we also appreciate a copy of the text file on the tape or disk. Please use high-quality 10 or 30 minute tapes with the program recorded on both sides. The tape or disk should be labeled with the author's name and the title of the article. Tapes are fairly sturdy, but disks need to be enclosed within plastic or cardboard mailers (available at photography, stationery, or computer supply stores).

10. A good general rule is to spell out the numbers zero through ten in your article and write higher numbers as numerals (1024). The exceptions to this are: Figure 5, Table 3, TAB(4), etc. Within ordinary text, however, the zero through ten should appear as words, not numbers. Also, symbols and abbreviations should not be used within text: use "and" (not &), "reference" (not ref.), "through" (not thru).

11. For greater clarity, use all capitals when referring to keys (RETURN, CTRL, SHIFT), BASIC words (LIST, RND, GOTO), and the language BASIC. Headlines and subheads should, however, be initial caps only, and emphasized words are not capitalized. If you wish to emphasize, underline the word and it will be italicized during typesetting.

12. Articles can be of any length—from a single-line routine to a multi-issue series. The average article is about four to eight double-spaced, typed pages.

13. If you want to include photographs, they should be either 5×7 black and white glossies or color slides.

14. We do not consider articles which are submitted simultaneously to other publishers. If you wish to send an article to another magazine for consideration, please do not submit it to us.

15. COMPUTE!'s GAZETTE pays between $70 and $800 for published articles. In general, the rate reflects the length and quality of the article. Payment is made upon acceptance. Following submission (Editorial Department, COMPUTE!'s GAZETTE, P.O. Box 5406, Greensboro, NC 27403) it will take from two to four weeks for us to reply. If your work is accepted, you will be notified by a letter which will include a contract for you to sign and return. *Rejected manuscripts are returned to authors who enclose a self-addressed, stamped envelope.*

16. If your article is accepted and you have since made improvements to the program, please submit an entirely new tape or disk and a new copy of the article reflecting the update. We cannot easily make revisions to programs and articles. It is necessary that you send the revised version as if it were a new submission entirely, but be sure to indicate that your submission is a revised version by writing, "Revision" on the envelope and the article.

17. COMPUTE!'s GAZETTE does not accept unsolicited product reviews. If you are interested in serving on our panel of reviewers, contact our Features Editor for details.

How To Type In *COMPUTE!'s GAZETTE* Programs

Each month, COMPUTE!'s GAZETTE publishes programs for the Commodore 128, 64, Plus/4, 16, and VIC-20. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. All 64 programs run on the 128 in 64 mode. Be sure to read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We frequently publish two programs designed to make typing easier: The Automatic Proofreader, and MLX, designed for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off then back on, erasing whatever was in memory. So be sure to *save a copy of your program before you run it.* If your computer crashes, you can always reload the program and look for the error.

Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from the GAZETTE, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be *shifted* (hold down the SHIFT key while pressing another key), the character is underlined. For example, A means hold down the SHIFT key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight SHIFTed A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the CTRL key while typing the letter in braces. For example, {A} means to press CTRL-A.

The Quote Mode

Although you can move the cursor around the screen with the CRSR keys, often a programmer will want to move the cursor under program control. This is seen in examples such as {LEFT} and {HOME} in the program listings. The only way the computer can tell the difference between direct and programmed cursor control is *the quote mode.*

Once you press the quote key, you're in quote mode. This mode can be confusing if you mistype a character and cursor left to change it. You'll see a reverse video character (a graphics symbol for cursor left). In this case, you can use the DELete key to back up and edit the line. Type another quote and you're out of quote mode. If things really get confusing, you can exit quote mode simply by pressing RETURN. Then just cursor up to the mistyped line and fix it.

When You Read:	Press:	See:
{CLR}	SHIFT + CLR/HOME	
{HOME}	CLR/HOME	
{UP}	SHIFT + ↑ CRSR ↓	
{DOWN}	↑ CRSR ↓	
{LEFT}	SHIFT + ← CRSR →	
{RIGHT}	← CRSR →	
{RVS}	CTRL + 9	
{OFF}	CTRL + 0	
{BLK}	CTRL + 1	
{WHT}	CTRL + 2	
{RED}	CTRL + 3	
{CYN}	CTRL + 4	

When You Read:	Press:	See:
{PUR}	CTRL + 5	
{GRN}	CTRL + 6	
{BLU}	CTRL + 7	
{YEL}	CTRL + 8	
{ F1 }	f1	
{ F2 }	SHIFT + f1	
{ F3 }	f3	
{ F4 }	SHIFT + f3	
{ F5 }	f5	
{ F6 }	SHIFT + f5	
{ F7 }	f7	
{ F8 }	SHIFT + f7	

When You Read:	Press:	See:
←	←	
↑	SHIFT + ↑	

For Commodore 64 Only

[1]	COMMODORE + 1
[2]	COMMODORE + 2
[3]	COMMODORE + 3
[4]	COMMODORE + 4
[5]	COMMODORE + 5
[6]	COMMODORE + 6
[7]	COMMODORE + 7
[8]	COMMODORE + 8

The Automatic Proofreader

Philip I. Nelson, Assistant Editor

"The Automatic Proofreader" helps you type in program listings for the 128, 64, Plus/4, 16, and VIC-20 and prevents nearly every kind of typing mistake.

Type in the Proofreader *exactly* as listed. Since the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unfamiliar commands. After finishing, save a copy or two on disk or tape before running it. This is important because the Proofreader erases the BASIC portion of itself when you run it, leaving only the machine language portion in memory.

Next, type RUN and press RETURN. After announcing which computer it's running on, the Proofreader displays the message "Proofreader Active". Now you're ready to type in a BASIC program.

Every time you finish typing a line and press RETURN, the Proofreader displays a two-letter checksum in the upper-left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, it's almost certain the line was typed correctly. If the letters don't match, check for your mistake and correct the line.

The Proofreader ignores spaces not enclosed in quotes, so you can omit or add spaces between keywords and still see a matching checksum. However, since spaces inside quotes are almost always significant, the Proofreader pays attention to them. For example, **10 PRINT"THIS IS BASIC"** will generate a different checksum than **10 PRINT"THIS ISBA SIC"**.

A common typing error is transposition—typing two successive characters in the wrong order, like PIRNT instead of PRINT or 64378 instead of 64738. The Proofreader is sensitive to the *position* of each character within the line and thus catches transposition errors.

The Proofreader does *not* accept keyword abbreviations (for example, ? instead of PRINT). If you prefer to use abbreviations, you can still check the line by LISTing it after typing it in, moving the cursor back to the line, and pressing RETURN. LISTing the line substitutes the full keyword for the abbreviation and allows the Proofreader to work properly. The same technique works for rechecking programs you've already typed in.

If you're using the Proofreader on the Commodore 128, Plus/4, or 16, *do not perform any GRAPHIC commands while the Proofreader is active.* When you perform a command like GRAPHIC 1, the computer moves everything at the start of BASIC program space—including the Proofreader—to another memory area, causing the Proofreader to crash. The same thing happens if you *run* any program with a GRAPHIC command while the Proofreader is in memory.

Though the Proofreader doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program. However, the Proofreader is purposely difficult to dislodge: It's not affected by tape or disk operations, or by pressing RUN/STOP- RESTORE. The simplest way to disable it is to turn the computer off then on. A gentler method is to SYS to the computer's built-in reset routine (SYS 65341 for the 128, 64738 for the 64, 65526 for the Plus/4 and 16, and 64802 for the VIC). These reset routines erase any program in memory, so be sure to save the program you're typing in before entering the SYS command.

If you own a Commodore 64, you may already have wondered whether the Proofreader works with other programming utilities like "MetaBASIC." The answer is generally yes, *if you're using a 64 and activate the Proofreader after installing the other utility.* For example, first load and activate MetaBASIC, then load and run the Proofreader.

When using the Proofreader with another utility, you should disable *both* programs before running a BASIC program. While the Proofreader seems unaffected by most utilities, there's no way to promise that it will work with any and every combination of utilities you might want to use. The more utilities activated, the more fragile the system becomes.

The New Automatic Proofreader

```
10 VEC=PEEK(772)+256*PEEK(773)
   :LO=43:HI=44
20 PRINT "AUTOMATIC PROOFREADE
   R FOR ";:IF VEC=42364 THEN
   {SPACE}PRINT "C-64"
30 IF VEC=50556 THEN PRINT "VI
   C-20"
40 IF VEC=35158 THEN GRAPHIC C
   LR:PRINT "PLUS/4 & 16"
50 IF VEC=17165 THEN LO=45:HI=
   46:GRAPHIC CLR:PRINT"128"
60 SA=(PEEK(LO)+256*PEEK(HI))+
   6:ADR=SA
70 FOR J=0 TO 166:READ BYT:POK
   E ADR,BYT:ADR=ADR+1:CHK=CHK
   +BYT:NEXT
80 IF CHK<>20570 THEN PRINT "*
   ERROR* CHECK TYPING IN DATA
    STATEMENTS":END
90 FOR J=1 TO 5:READ RF,LF,HF:
   RS=SA+RF:HB=INT(RS/256):LB=
   RS-(256*HB)
100 CHK=CHK+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
110 IF CHK<>22054 THEN PRINT "
   *ERROR* RELOAD PROGRAM AND
   {SPACE}CHECK FINAL LINE":EN
   D
120 POKE SA+149,PEEK(772):POKE
    SA+150,PEEK(773)
130 IF VEC=17165 THEN POKE SA+
   14,22:POKE SA+18,23:POKESA+
   29,224:POKESA+139,224
140 PRINT CHR$(147);CHR$(17);"
   PROOFREADER ACTIVE":SYS SA
150 POKE HI,PEEK(HI)+1:POKE (P
   EEK(LO)+256*PEEK(HI))-1,0:N
   EW
160 DATA 120,169,73,141,4,3,16
   9,3,141,5,3
170 DATA 88,96,165,20,133,167,
   165,21,133,168,169
180 DATA 0,141,0,255,162,31,18
   1,199,157,227,3
190 DATA 202,16,248,169,19,32,
   210,255,169,18,32
200 DATA 210,255,160,0,132,180
   ,132,176,136,230,180
210 DATA 200,185,0,2,240,46,20
   1,34,208,8,72
220 DATA 165,176,73,255,133,17
   6,104,72,201,32,208
230 DATA 7,165,176,208,3,104,2
   08,226,104,166,180
240 DATA 24,165,167,121,0,2,13
   3,167,165,168,105
250 DATA 0,133,168,202,208,239
   ,240,202,165,167,69
260 DATA 168,72,41,15,168,185,
   211,3,32,210,255
270 DATA 104,74,74,74,74,168,1
   85,211,3,32,210
280 DATA 255,162,31,189,227,3,
   149,199,202,16,248
290 DATA 169,146,32,210,255,76
   ,86,137,65,66,67
300 DATA 68,69,70,71,72,74,75,
   77,80,81,82,83,88
310 DATA 13,2,7,167,31,32,151,
   116,117,151,128,129,167,136
   ,137
```

MLX Machine Language Entry Program For Commodore 64 and 128

Ottis R. Cowper, Technical Editor

"MLX" is a labor-saving utility that allows almost fail-safe entry of machine language programs. Included are versions for the Commodore 64 and 128.

Type in and save some copies of whichever version of MLX is appropriate for your computer (you'll want to use it to enter future ML programs from COMPUTE!'s GAZETTE). Program 1 is for the Commodore 64, and Program 2 is for the 128 (128 MLX can also be used to enter Commodore 64 ML programs for use in 64 mode). When you're ready to enter an ML program, load and run MLX. It asks you for a starting address and an ending address. These addresses appear in the article accompanying the MLX-format program listing you're typing.

If you're unfamiliar with machine language, the addresses (and all other values you enter in MLX) may appear strange. Instead of the usual decimal numbers you're accustomed to, these numbers are in *hexadecimal*—a base 16 numbering system commonly used by ML programmers. Hexadecimal—hex for short—includes the numerals 0–9 and the letters A–F. But don't worry—even if you know nothing about ML or hex, you should have no trouble using MLX.

After you enter the starting and ending addresses, you'll be offered the option of clearing the workspace. Choose this option if you're starting to enter a new listing. If you're continuing a listing that's partially typed from a previous session, don't choose this option.

A functions menu will appear. The first option in the menu is ENTER DATA. If you're just starting to type in a program, pick this. Press the E key, and type the first number in the first line of the program listing. If you've already typed in part of a program, type the line number where you left off typing at the end of the previous session (be sure to load the partially completed program before you resume entry). In any case, make sure the address you enter corresponds to the address of a line in the listing you are entering. Otherwise, you'll be unable to enter the data correctly. If you pressed E by mistake, you can return to the command menu by pressing RETURN alone when asked for the address. (You can get back to the menu from most options by pressing RETURN with no other input.)

Entering A Listing

Once you're in Enter mode, MLX prints the address for each program line for you. You then type in all nine numbers on that line, beginning with the first two-digit number after the colon (:). Each line represents eight data bytes and a checksum. Although an MLX-format listing appears similar to the "hex dump" listings from a machine language monitor program, the extra checksum number on the end allows MLX to check your typing. (Commodore 128 users *can* enter the data from an MLX listing using the built-in monitor if the rightmost column of data is omitted, but we recommend against it. It's much easier to let MLX do the proofreading and error checking for you.)

When you enter a line, MLX recalculates the checksum from the eight bytes and the address and compares this value to the number from the ninth column. If the values match, you'll hear a bell tone, the data will be added to the workspace area, and the prompt for the next line of data will appear. But if MLX detects a typing error, you'll hear a low buzz and see an error message. The line will then be redisplayed for editing.

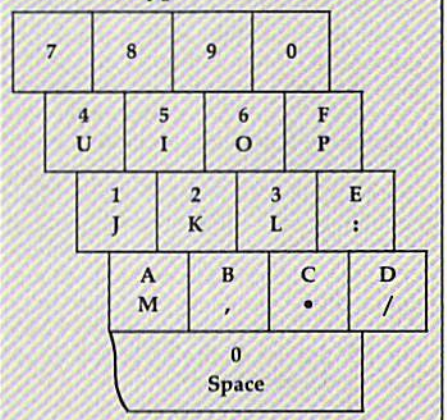
Invalid Characters Banned

Only a few keys are active while you're entering data, so you may have to unlearn some habits. You *do not* type spaces between the columns; MLX automatically inserts these for you. You *do not* press RETURN after typing the last number in a line; MLX automatically enters and checks the line after you type the last digit.

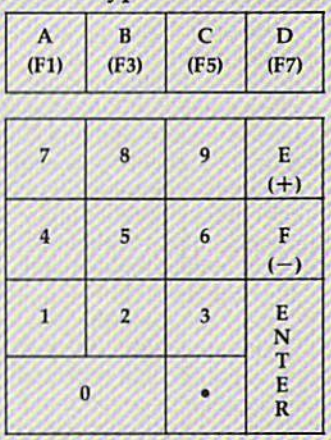
Only the numerals 0–9 and the letters A–F can be typed in. If you press any other key (with some exceptions noted below), you'll hear a warning buzz. To simplify typing, 128 MLX redefines the function keys and + and − keys on the numeric keypad so that you can enter data one-handed. (The 64 version incorporates the keypad modification from the March 1986 "Bug-Swatter" column, lines 485–487.) In either case, the keypad is active only while entering data. Addresses must be entered with the normal letter and number keys. The figures below show the keypad configurations for each version.

MLX checks for transposed characters. If you're supposed to type in A0 and instead enter 0A, MLX will catch your mistake. There is one error that can slip past MLX: Because of the checksum formula used, MLX won't notice if you accidentally type FF in place of 00, and vice versa. And there's a very slim chance that you could garble a line and still end up with a combination of characters that adds up to the proper checksum. However, these mistakes should not occur if you take reasonable care while entering data.

64 MLX Keypad



128 MLX Keypad



Editing Features

To correct typing mistakes before finishing a line, use the INST/DEL key to delete the character to the left of the cursor. (The cursor-left key also deletes.) If you mess up a line really badly, press CLR/HOME to start the line over. The RETURN key is also active, but only before any data is typed on a line. Pressing RETURN at this point returns you to the command menu. After you type a character of data, MLX disables RETURN until the cursor returns to the start of a line. Remember, you can press CLR/HOME to quickly get to a line

number prompt.

More editing features are available when correcting lines in which MLX has detected an error. To make corrections in a line that MLX has redisplayed for editing, compare the line on the screen with the one printed in the listing, then move the cursor to the mistake and type the correct key. The cursor left and right keys provide the normal cursor controls. (The INST/DEL key now works as an alternative cursor-left key.) You cannot move left beyond the first character in the line. If you try to move beyond the rightmost character, you'll reenter the line. During editing, RETURN is active; pressing it tells MLX to recheck the line. You can press the CLR/HOME key to clear the entire line if you want to start from scratch, or if you want to get to a line number prompt to use RETURN to get back to the menu.

Display Data

The second menu choice, DISPLAY DATA, examines memory and shows the contents in the same format as the program listing (including the checksum). When you press D, MLX asks you for a starting address. Be sure that the starting address you give corresponds to a line number in the listing. Otherwise, the checksum display will be meaningless. MLX displays program lines until it reaches the end of the program, at which point the menu is redisplayed. You can pause the display by pressing the space bar. (MLX finishes printing the current line before halting.) Press space again to restart the display. To break out of the display and get back to the menu before the ending address is reached, press RETURN.

Other Menu Options

Two more menu selections let you save programs and load them back into the computer. These are SAVE FILE and LOAD FILE; their operation is quite straightforward. When you press S or L, MLX asks you for the filename. You'll then be asked to press either D or T to select disk or tape.

You'll notice the disk drive starting and stopping several times during a load or save (save only for the 128 version). Don't panic; this is normal behavior. MLX opens and reads from or writes to the file instead of using the usual LOAD and SAVE commands (128 MLX makes use of BLOAD). Disk users should also note that the drive prefix 0: is automatically added to the filename (line 750 in 64 MLX), so this should *not* be included when entering the name. This also precludes the use of @ for Save-with-Replace, so remember to give each version you save a different name. The 128 version makes up for this by giving you the option of scratching the existing file if you want to reuse a filename.

Remember that MLX saves the entire workspace area from the starting address to the ending address, so the save or load may take longer than you might expect if you've entered only a small amount of data from a long listing. When saving a partially completed listing, make sure to note the address where you stopped typing so you'll know where to resume entry when you reload.

MLX reports the standard disk or tape error messages if any problems are detected during the save or load. (Tape users should bear in mind that Commodore computers are never able to detect errors during a save to tape.) MLX also has three special load error messages: INCORRECT STARTING ADDRESS, which means the file you're trying to load does not have the starting address you specified when you ran MLX; LOAD ENDED AT *address*, which means the file you're trying to load ends before the ending address you specified when you started MLX; and TRUNCATED AT ENDING ADDRESS, which means the file you're trying to load extends beyond the ending address you specified when you started MLX. If you see one of these messages and feel certain that you've loaded the right file, exit and rerun MLX, being careful to enter the correct starting and ending addresses.

The 128 version also has a CATALOG DISK option so you can view the contents of the disk directory before saving or loading.

The QUIT menu option has the obvious effect—it stops MLX and enters BASIC. The RUN/STOP key is disabled, so the Q option lets you exit the program without turning off the computer. (Of course, RUN/STOP-RESTORE also gets you out.) You'll be asked for verification; press Y to exit to BASIC, or any other key to return to the menu. After quitting, you can type RUN again and reenter MLX without losing your data, as long as you don't use the clear workspace option.

The Finished Product

When you've finished typing all the data for an ML program and saved your work, you're ready to see the results. The instructions for loading and using the finished product vary from program to program. Some ML programs are designed to be loaded and run like BASIC programs, so all you need to type is LOAD *"filename"*,8 for disk (DLOAD *"filename"* on the 128) or LOAD *"filename"* for tape, and then RUN. Such programs will usually have a starting address of 0801 for the 64 or 1C01 for the 128. Other programs must be reloaded to specific addresses with a command such as LOAD *"filename"*,8,1 for disk (BLOAD *"filename"* on the 128) or LOAD *"filename"*,1,1 for tape, then started with a SYS to a particular memory address. On the Commodore 64, the most common starting address for such programs is 49152, which corresponds to MLX address C000. In either case, you should always refer to the article which accompanies the ML listing for information on loading and running the program.

An Ounce Of Prevention

By the time you finish typing in the data for a long ML program, you may have several hours invested in the project. Don't take chances—use our "Automatic Proofreader" to type the new MLX, and then test your copy *thoroughly* before first using it to enter any significant amount of data. Make sure all the menu options work as they should. Enter fragments of the program starting at several different addresses, then use the Display option to verify that the data has been entered correctly. And be sure to test the Save and Load options several times to ensure that you can recall your work from disk or tape. Don't let a simple typing error in the new MLX cost you several nights of hard work.

Program 1: MLX For Commodore 64

```
SS 10 REM VERSION 1.1: LINES 8
      30,950 MODIFIED, LINES 4
      85-487 ADDED
EK 100 POKE 56,50:CLR:DIM IN$,
      I,J,A,B,A$,B$,A(7),N$
DM 110 C4=48:C6=16:C7=7:Z2=2:Z
      4=254:Z5=255:Z6=256:Z7=
      127
CJ 120 FA=PEEK(45)+Z6*PEEK(46)
      :BS=PEEK(55)+Z6*PEEK(56
      ):H$="0123456789ABCDEF"
SB 130 R$=CHR$(13):L$="{LEFT}"
      :S$=" ":D$=CHR$(20):Z$=
      CHR$(0):T$="{13 RIGHT}"
CQ 140 SD=54272:FOR I=SD TO SD
      +23:POKE I,0:NEXT:POKE
      {SPACE}SD+24,15:POKE 78
      8,52
FC 150 PRINT"{CLR}"CHR$(142)CH
      R$(8):POKE 53280,15:POK
      E 53281,15
EJ 160 PRINT T$" {RED}{RVS}
      {2 SPACES}{8 @}
      {2 SPACES}"SPC(28)"
      {2 SPACES}{OFF}{BLU} ML
      X II {RED}{RVS}
      {2 SPACES}"SPC(28)"
      {12 SPACES}{BLU}"
FR 170 PRINT"{3 DOWN}
      {3 SPACES}COMPUTE!'S MA
      CHINE LANGUAGE EDITOR
      {3 DOWN}"
JB 180 PRINT"{BLK}STARTING ADD
```

```
      RESS[4]";:GOSUB300:SA=A
      D:GOSUB1040:IF F THEN18
      0
GF 190 PRINT"{BLK}{2 SPACES}EN
      DING ADDRESS[4]";:GOSUB
      300:EA=AD:GOSUB1030:IF
      {SPACE}F THEN190
KR 200 INPUT"{3 DOWN}{BLK}CLEA
      R WORKSPACE [Y/N][4]";A
      $:IF LEFT$(A$,1)<>"Y"TH
      EN220
PG 210 PRINT"{2 DOWN}{BLU}WORK
      ING...";:FORI=BS TO BS+
      EA-SA+7:POKE I,0:NEXT:P
      RINT"DONE"
DR 220 PRINTTAB(10)"{2 DOWN}
      {BLK}{RVS} MLX COMMAND
      {SPACE}MENU {DOWN}[4]":
      PRINT T$"{RVS}E{OFF}NTE
      R DATA"
BD 230 PRINT T$"{RVS}D{OFF}ISP
      LAY DATA":PRINT T$"
      {RVS}L{OFF}OAD FILE"
JS 240 PRINT T$"{RVS}S{OFF}AVE
       FILE":PRINT T$"{RVS}Q
      {OFF}UIT{2 DOWN}{BLK}"
JH 250 GET A$:IF A$=N$ THEN250
HK 260 A=0:FOR I=1 TO 5:IF A$=
      MID$("EDLSQ",I,1)THEN A
      =I:I=5
FD 270 NEXT:ON A GOTO420,610,6
      90,700,280:GOSUB1060:GO
      TO250
EJ 280 PRINT"{RVS} QUIT ":INPU
      T"{DOWN}[4]ARE YOU SURE
       [Y/N]";A$:IF LEFT$(A$,
      1)<>"Y"THEN220
EM 290 POKE SD+24,0:END
JX 300 IN$=N$:AD=0:INPUTIN$:IF
      LEN(IN$)<>4THENRETURN
KF 310 B$=IN$:GOSUB320:AD=A:B$
      =MID$(IN$,3):GOSUB320:A
      D=AD*256+A:RETURN
PP 320 A=0:FOR J=1 TO 2:A$=MID
      $(B$,J,1):B=ASC(A$)-C4+
      (A$>"@")*C7:A=A*C6+B
JA 330 IF B<0 OR B>15 THEN AD=
      0:A=-1:J=2
GX 340 NEXT:RETURN
CH 350 B=INT(A/C6):PRINT MID$(
      H$,B+1,1);:B=A-B*C6:PRI
      NT MID$(H$,B+1,1);:RETU
      RN
RR 360 A=INT(AD/Z6):GOSUB350:A
      =AD-A*Z6:GOSUB350:PRINT
      ":";
BE 370 CK=INT(AD/Z6):CK=AD-Z4*
      CK+Z5*(CK>Z7):GOTO390
PX 380 CK=CK*Z2+Z5*(CK>Z7)+A
JC 390 CK=CK+Z5*(CK>Z5):RETURN
QS 400 PRINT"{DOWN}STARTING AT
      [4]";:GOSUB300:IF IN$<>
      N$ THEN GOSUB1030:IF F
      {SPACE}THEN400
EX 410 RETURN
HD 420 PRINT"{RVS} ENTER DATA
      {SPACE}":GOSUB400:IF IN
      $=N$ THEN220
JK 430 OPEN3,3:PRINT
SK 440 POKE198,0:GOSUB360:IF F
       THEN PRINT IN$:PRINT"
      {UP}{5 RIGHT}";
GC 450 FOR I=0 TO 24 STEP 3:B$
      =S$:FOR J=1 TO 2:IF F T
      HEN B$=MID$(IN$,I+J,1)
HA 460 PRINT"{RVS}"B$L$;:IF I<
      24THEN PRINT"{OFF}";
HD 470 GET A$:IF A$=N$ THEN470
FK 480 IF(A$>"/"ANDA$<":")OR(A
      $>"@"ANDA$<"G")THEN540
GS 485 A=-(A$="M")-2*(A$=",")-
      3*(A$=".")-4*(A$="/")-5
      *(A$="J")-6*(A$="K")
FX 486 A=A-7*(A$="L")-8*(A$=":
      ")-9*(A$="U")-10*(A$="I
      ")-11*(A$="O")-12*(A$="
      P")
CM 487 A=A-13*(A$=S$):IF A THE
      N A$=MID$("ABCD123E456F
      0",A,1):GOTO 540
MP 490 IF A$=R$ AND((I=0)AND(J
      =1)OR F)THEN PRINT B$;:
      J=2:NEXT:I=24:GOTO550
KC 500 IF A$="{HOME}" THEN PRI
      NT B$:J=2:NEXT:I=24:NEX
      T:F=0:GOTO440
MX 510 IF(A$="{RIGHT}")ANDF TH
      ENPRINT B$L$;:GOTO540
GK 520 IF A$<>L$ AND A$<>D$ OR
      ((I=0)AND(J=1))THEN GOS
      UB1060:GOTO470
HG 530 A$=L$+S$+L$:PRINT B$L$;
      :J=2-J:IF J THEN PRINT
      {SPACE}L$;:I=I-3
QS 540 PRINT A$;:NEXT J:PRINT
      {SPACE}S$;
PM 550 NEXT I:PRINT:PRINT"{UP}
      {5 RIGHT}";:INPUT#3,IN$
      :IF IN$=N$ THEN CLOSE3:
      GOTO220
QC 560 FOR I=1 TO 25 STEP3:B$=
      MID$(IN$,I):GOSUB320:IF
       I<25 THEN GOSUB380:A(I
      /3)=A
PK 570 NEXT:IF A<>CK THEN GOSU
      B1060:PRINT"{BLK}{RVS}
      {SPACE}ERROR: REENTER L
      INE [4]":F=1:GOTO440
HJ 580 GOSUB1080:B=BS+AD-SA:FO
      R I=0 TO 7:POKE B+I,A(I
      ):NEXT
QQ 590 AD=AD+8:IF AD>EA THEN C
      LOSE3:PRINT"{DOWN}{BLU}
      ** END OF ENTRY **{BLK}
      {2 DOWN}":GOTO700
GQ 600 F=0:GOTO440
QA 610 PRINT"{CLR}{DOWN}{RVS}
      {SPACE}DISPLAY DATA ":G
      OSUB400:IF IN$=N$ THEN2
      20
RJ 620 PRINT"{DOWN}{BLU}PRESS:
       {RVS}SPACE{OFF} TO PAU
      SE, {RVS}RETURN{OFF} TO
       BREAK[4]{DOWN}"
KS 630 GOSUB360:B=BS+AD-SA:FOR
      I=BTO B+7:A=PEEK(I):GOS
      UB350:GOSUB380:PRINT S$
      ;
CC 640 NEXT:PRINT"{RVS}";:A=CK
      :GOSUB350:PRINT
KH 650 F=1:AD=AD+8:IF AD>EA TH
      ENPRINT"{DOWN}{BLU}** E
      ND OF DATA **":GOTO220
KC 660 GET A$:IF A$=R$ THEN GO
      SUB1080:GOTO220
EQ 670 IF A$=S$ THEN F=F+1:GOS
      UB1080
AD 680 ONFGOTO630,660,630
CM 690 PRINT"{DOWN}{RVS} LOAD
      {SPACE}DATA ":OP=1:GOTO
      710
PC 700 PRINT"{DOWN}{RVS} SAVE
      {SPACE}FILE ":OP=0
RX 710 IN$=N$:INPUT"{DOWN}FILE
      NAME[4]";IN$:IF IN$=N$
      {SPACE}THEN220
PR 720 F=0:PRINT"{DOWN}{BLK}
      {RVS}T{OFF}APE OR {RVS}
      D{OFF}ISK: [4]";
FP 730 GET A$:IF A$="T"THEN PR
      INT"T{DOWN}":GOTO880
HQ 740 IF A$<>"D"THEN730
HH 750 PRINT"D{DOWN}":OPEN15,8
      ,15,"I0:":B=EA-SA:IN$="
      0:"+IN$:IF OP THEN810
SQ 760 OPEN 1,8,8,IN$+",P,W":G
      OSUB860:IF A THEN220
FJ 770 AH=INT(SA/256):AL=SA-(A
      H*256):PRINT#1,CHR$(AL)
      ;CHR$(AH);
PE 780 FOR I=0 TO B:PRINT#1,CH
      R$(PEEK(BS+I));:IF ST T
      HEN800
FC 790 NEXT:CLOSE1:CLOSE15:GOT
      O940
GS 800 GOSUB1060:PRINT"{DOWN}
      {BLK}ERROR DURING SAVE:
      [4]":GOSUB860:GOTO220
MA 810 OPEN 1,8,8,IN$+",P,R":G
      OSUB860:IF A THEN220
GE 820 GET#1,A$,B$:AD=ASC(A$+Z
      $)+256*ASC(B$+Z$):IF AD
      <>SA THEN F=1:GOTO850
RX 830 FOR I=0 TO B:GET#1,A$:P
      OKE BS+I,ASC(A$+Z$):IF(
      I<>B)AND ST THEN F=2:AD
      =I:I=B
FA 840 NEXT:IF ST<>64 THEN F=3
FQ 850 CLOSE1:CLOSE15:ON ABS(F
      >0)+1 GOTO960,970
SA 860 INPUT#15,A,A$:IF A THEN
       CLOSE1:CLOSE15:GOSUB10
      60:PRINT"{RVS}ERROR: "A
      $
GQ 870 RETURN
EJ 880 POKE183,PEEK(FA+2):POKE
      187,PEEK(FA+3):POKE188,
      PEEK(FA+4):IFOP=0THEN92
      0
HJ 890 SYS 63466:IF(PEEK(783)A
      ND1)THEN GOSUB1060:PRIN
      T"{DOWN}{RVS} FILE NOT
      {SPACE}FOUND ":GOTO690
CS 900 AD=PEEK(829)+256*PEEK(8
      30):IF AD<>SA THEN F=1:
      GOTO970
SC 910 A=PEEK(831)+256*PEEK(83
      2)-1:F=F-2*(A<EA)-3*(A>
      EA):AD=A-AD:GOTO930
KM 920 A=SA:B=EA+1:GOSUB1010:P
      OKE780,3:SYS 63338
JF 930 A=BS:B=BS+(EA-SA)+1:GOS
      UB1010:ON OP GOTO950:SY
      S 63591
AE 940 GOSUB1080:PRINT"{BLU}**
       SAVE COMPLETED **":GOT
      O220
XP 950 POKE147,0:SYS 63562:IF
      {SPACE}ST>0 THEN970
FR 960 GOSUB1080:PRINT"{BLU}**
       LOAD COMPLETED **":GOT
      O220
DP 970 GOSUB1060:PRINT"{BLK}
      {RVS}ERROR DURING LOAD:
      {DOWN}[4]":ON F GOSUB98
      0,990,1000:GOTO220
PP 980 PRINT"INCORRECT STARTIN
      G ADDRESS (";:GOSUB360:
      PRINT")":RETURN
GR 990 PRINT"LOAD ENDED AT ";:
      AD=SA+AD:GOSUB360:PRINT
       D$:RETURN
FD 1000 PRINT"TRUNCATED AT END
      ING ADDRESS":RETURN
RX 1010 AH=INT(A/256):AL=A-(AH
      *256):POKE193,AL:POKE1
      94,AH
FF 1020 AH=INT(B/256):AL=B-(AH
      *256):POKE174,AL:POKE1
      75,AH:RETURN
FX 1030 IF AD<SA OR AD>EA THEN
      1050
HA 1040 IF(AD>511 AND AD<40960
```

```
)OR(AD>49151 AND AD<53
248)THEN GOSUB1080:F=0
:RETURN
HC 1050 GOSUB1060:PRINT"{RVS}
{SPACE}INVALID ADDRESS
{DOWN}{BLK}":F=1:RETU
RN
AR 1060 POKE SD+5,31:POKE SD+6
,208:POKE SD,240:POKE
{SPACE}SD+1,4:POKE SD+
4,33
DX 1070 FOR S=1 TO 100:NEXT:GO
TO1090
PF 1080 POKE SD+5,8:POKE SD+6,
240:POKE SD,0:POKE SD+
1,90:POKE SD+4,17
AC 1090 FOR S=1 TO 100:NEXT:PO
KE SD+4,0:POKE SD,0:PO
KE SD+1,0:RETURN
```

Program 2: MLX For Commodore 128

```
AE 100 TRAP 960:POKE 4627,128:
DIM NL$,A(7)
XP 110 Z2=2:Z4=254:Z5=255:Z6=2
56:Z7=127:BS=256*PEEK(4
627):EA=65280
FB 120 BE$=CHR$(7):RT$=CHR$(13
):DL$=CHR$(20):SP$=CHR$
(32):LF$=CHR$(157)
KE 130 DEF FNHB(A)=INT(A/256):
DEF FNLB(A)=A-FNHB(A)*2
56:DEF FNAD(A)=PEEK(A)+
256*PEEK(A+1)
JB 140 KEY 1,"A":KEY 3,"B":KEY
5,"C":KEY 7,"D":VOL 15
:IF RGR(0)=5 THEN FAST
FJ 150 PRINT"{CLR}"CHR$(142);C
HR$(8):COLOR 0,15:COLOR
4,15:COLOR 6,15
GQ 160 PRINT TAB(12)"{RED}
{RVS}{2 SPACES}{9 @}
{2 SPACES}"RT$;TAB(12)"
{RVS}{2 SPACES}{OFF}
{BLU} 128 MLX {RED}
{RVS}{2 SPACES}"RT$;TAB
(12)"{RVS}{13 SPACES}
{BLU}"
FE 170 PRINT"{2 DOWN}
{3 SPACES}COMPUTE!'S MA
CHINE LANGUAGE EDITOR
{2 DOWN}"
DK 180 PRINT"{BLK}STARTING ADD
RESS{4}";:GOSUB 260:IF
{SPACE}AD THEN SA=AD:EL
SE 180
FH 190 PRINT"{BLK}{2 SPACES}EN
DING ADDRESS{4}";:GOSUB
260:IF AD THEN EA=AD:E
LSE 190
MF 200 PRINT"{DOWN}{BLK}CLEAR
{SPACE}WORKSPACE [Y/N]?
{4}":GETKEY A$:IF A$<>"
Y" THEN 220
QH 210 PRINT"{DOWN}{BLU}WORKIN
G...";:BANK 0:FOR A=BS
{SPACE}TO BS+(EA-SA)+7:
POKE A,0:NEXT A:PRINT"D
ONE"
DC 220 PRINT TAB(10)"{DOWN}
{BLK}{RVS} MLX COMMAND
{SPACE}MENU {4}{DOWN}":
PRINT TAB(13)"{RVS}E
{OFF}NTER DATA"RT$;TAB(
13)"{RVS}D{OFF}ISPLAY D
ATA"RT$;TAB(13)"{RVS}L
{OFF}OAD FILE"
HB 230 PRINT TAB(13)"{RVS}S
{OFF}AVE FILE"RT$;TAB(1
3)"{RVS}C{OFF}ATALOG DI
SK"RT$;TAB(13)"{RVS}Q
{OFF}UIT{DOWN}{BLK}"
AP 240 GETKEY A$:A=INSTR("EDLS
CQ",A$):ON A GOTO 340,5
50,640,650,930,940:GOSU
B 950:GOTO 240
SX 250 PRINT"STARTING AT";:GOS
UB 260:IF(AD<>0)OR(A$=N
L$)THEN RETURN:ELSE 250
BG 260 A$=NL$:INPUT A$:IF LEN(
A$)=4 THEN AD=DEC(A$)
PP 270 IF AD=0 THEN BEGIN:IF A
$<>NL$ THEN 300:ELSE RE
TURN:BEND
MA 280 IF AD<SA OR AD>EA THEN
{SPACE}300
PM 290 IF AD>511 AND AD<65280
{SPACE}THEN PRINT BE$;:
RETURN
SQ 300 GOSUB 950:PRINT"{RVS} I
NVALID ADDRESS {DOWN}
{BLK}":AD=0:RETURN
RD 310 CK=FNHB(AD):CK=AD-Z4*CK
+Z5*(CK>Z7):GOTO 330
DD 320 CK=CK*Z2+Z5*(CK>Z7)+A
AH 330 CK=CK+Z5*(CK>Z5):RETURN
QD 340 PRINT BE$;"{RVS} ENTER
{SPACE}DATA ":GOSUB 250
:IF A$=NL$ THEN 220
JA 350 BANK 0:PRINT:F=0:OPEN 3
,3
BR 360 GOSUB 310:PRINT HEX$(AD
)+":";:IF F THEN PRINT
{SPACE}L$:PRINT"{UP}
{5 RIGHT}";
QA 370 FOR I=0 TO 24 STEP 3:B$
=SP$:FOR J=1 TO 2:IF F
{SPACE}THEN B$=MID$(L$,
I+J,1)
PS 380 PRINT"{RVS}"B$+LF$;:IF
{SPACE}I<24 THEN PRINT"
{OFF}";
RC 390 GETKEY A$:IF (A$>"/" AN
D A$<":") OR(A$>"@" AND
A$<"G") THEN 470
AC 400 IF A$="+" THEN A$="E":G
OTO 470
QB 410 IF A$="-" THEN A$="F":G
OTO 470
FB 420 IF A$=RT$ AND ((I=0) AN
D (J=1) OR F) THEN PRIN
T B$;:J=2:NEXT:I=24:GOT
O 480
RD 430 IF A$="{HOME}" THEN PRI
NT B$:J=2:NEXT:I=24:NEX
T:F=0:GOTO 360
XB 440 IF (A$="{RIGHT}") AND F
THEN PRINT B$+LF$;:GOT
O 470
JP 450 IF A$<>LF$ AND A$<>DL$
{SPACE}OR ((I=0) AND (J
=1)) THEN GOSUB 950:GOT
O 390
PS 460 A$=LF$+SP$+LF$:PRINT B$
+LF$;:J=2-J:IF J THEN P
RINT LF$;:I=I-3
GB 470 PRINT A$;:NEXT J:PRINT
{SPACE}SP$;
HA 480 NEXT I:PRINT:PRINT"{UP}
{5 RIGHT}";:L$="
{27 SPACES}"
DP 490 FOR I=1 TO 25 STEP 3:GE
T#3,A$,B$:IF A$=SP$ THE
N I=25:NEXT:CLOSE 3:GOT
O 220
BA 500 A$=A$+B$:A=DEC(A$):MID$
(L$,I,2)=A$:IF I<25 THE
N GOSUB 320:A(I/3)=A:GE
T#3,A$
AR 510 NEXT I:IF A<>CK THEN GO
SUB 950:PRINT:PRINT"
{RVS} ERROR: REENTER LI
NE ":F=1:GOTO 360
DX 520 PRINT BE$:B=BS+AD-SA:FO
R I=0 TO 7:POKE B+I,A(I
):NEXT I
XB 530 F=0:AD=AD+8:IF AD<=EA T
HEN 360
CA 540 CLOSE 3:PRINT"{DOWN}
{BLU}** END OF ENTRY **
{BLK}{2 DOWN}":GOTO 650
MC 550 PRINT BE$;"{CLR}{DOWN}
{RVS} DISPLAY DATA ":GO
SUB 250:IF A$=NL$ THEN
{SPACE}220
JF 560 BANK 0:PRINT"{DOWN}
{BLU}PRESS: {RVS}SPACE
{OFF} TO PAUSE, {RVS}RE
TURN{OFF} TO BREAK{4}
{DOWN}"
XA 570 PRINT HEX$(AD)+":";:GOS
UB 310:B=BS+AD-SA
DJ 580 FOR I=B TO B+7:A=PEEK(I
):PRINT RIGHT$(HEX$(A),
2);SP$;:GOSUB 320:NEXT
{SPACE}I
XB 590 PRINT"{RVS}";RIGHT$(HEX
$(CK),2)
GR 600 F=1:AD=AD+8:IF AD>EA TH
EN PRINT"{BLU}** END OF
DATA **":GOTO 220
EB 610 GET A$:IF A$=RT$ THEN P
RINT BE$:GOTO 220
QK 620 IF A$=SP$ THEN F=F+1:PR
INT BE$;
XS 630 ON F GOTO 570,610,570
RF 640 PRINT BE$"{DOWN}{RVS} L
OAD DATA ":OP=1:GOTO 66
0
BP 650 PRINT BE$"{DOWN}{RVS} S
AVE FILE ":OP=0
DM 660 F=0:F$=NL$:INPUT"FILENA
ME{4}";F$:IF F$=NL$ THE
N 220
RF 670 PRINT"{DOWN}{BLK}{RVS}T
{OFF}APE OR {RVS}D{OFF}
ISK: {4}";
SQ 680 GETKEY A$:IF A$="T" THE
N 850:ELSE IF A$<>"D" T
HEN 680
SP 690 PRINT"DISK{DOWN}":IF OP
THEN 760
EG 700 DOPEN#1,(F$+",P"),W:IF
{SPACE}DS THEN A$=DS$:G
OTO 740
JH 710 BANK 0:POKE BS-2,FNLB(S
A):POKE BS-1,FNHB(SA):P
RINT"SAVING ";F$:PRINT
MC 720 FOR A=BS-2 TO BS+EA-SA:
PRINT#1,CHR$(PEEK(A));:
IF ST THEN A$="DISK WRI
TE ERROR":GOTO 750
GC 730 NEXT A:CLOSE 1:PRINT"
{BLU}** SAVE COMPLETED
{SPACE}WITHOUT ERRORS *
*":GOTO 220
RA 740 IF DS=63 THEN BEGIN:CLO
SE 1:INPUT"{BLK}REPLACE
EXISTING FILE [Y/N]{4}
";A$:IF A$="Y" THEN SCR
ATCH(F$):PRINT:GOTO 700
:ELSE PRINT"{BLK}":GOTO
660:BEND
GA 750 CLOSE 1:GOSUB 950:PRINT
"{BLK}{RVS} ERROR DURIN
G SAVE: {4}":PRINT A$:G
OTO 220
FD 760 DOPEN#1,(F$+",P"):IF DS
THEN A$=DS$:F=4:CLOSE
{SPACE}1:GOTO 790
```

```
PX 770 GET#1,A$,B$:CLOSE 1:AD=
       ASC(A$)+256*ASC(B$):IF
       {SPACE}AD<>SA THEN F=1:
       GOTO 790
KB 780 PRINT"LOADING ";F$:PRIN
       T:BLOAD(F$),B0,P(BS):AD
       =SA+FNAD(174)-BS-1:F=-2
       *(AD<EA)-3*(AD>EA)
RQ 790 IF F THEN 800:ELSE PRIN
       T"{BLU}** LOAD COMPLETE
       D WITHOUT ERRORS **":GO
       TO 220
ER 800 GOSUB 950:PRINT"{BLK}
       {RVS} ERROR DURING LOAD
       : {4}":ON F GOSUB 810,8
       20,830,840:GOTO220
QJ 810 PRINT"INCORRECT STARTIN
       G ADDRESS (";HEX$(AD);"
       )":RETURN
DP 820 PRINT"LOAD ENDED AT ";H
       EX$(AD):RETURN
EB 830 PRINT"TRUNCATED AT ENDI
       NG ADDRESS ("HEX$(EA)")
       ":RETURN
FP 840 PRINT"DISK ERROR ";A$:R
       ETURN
KS 850 PRINT"TAPE":AD=POINTER(
       F$):BANK 1:A=PEEK(AD):A
       L=PEEK(AD+1):AH=PEEK(AD
       +2)
XX 860 BANK 15:SYS DEC("FF68")
       ,0,1:SYS DEC("FFBA"),1,
       1,0:SYS DEC("FFBD"),A,A
       L,AH:SYS DEC("FF90"),12
       8:IF OP THEN 890
FG 870 PRINT:A=SA:B=EA+1:GOSUB
        920:SYS DEC("E919"),3:
       PRINT"SAVING ";F$
AB 880 A=BS:B=BS+(EA-SA)+1:GOS
       UB 920:SYS DEC("EA18"):
       PRINT"{DOWN}{BLU}** TAP
       E SAVE COMPLETED **":GO
       TO 220
CP 890 SYS DEC("E99A"):PRINT:I
       F PEEK(2816)=5 THEN GOS
       UB 950:PRINT"{DOWN}
       {BLK}{RVS} FILE NOT FOU
       ND ":GOTO 220
GQ 900 PRINT"LOADING ...{DOWN}
       ":AD=FNAD(2817):IF AD<>
       SA THEN F=1:GOTO 800:EL
       SE AD=FNAD(2819)-1:F=-2
       *(AD<EA)-3*(AD>EA)
JD 910 A=BS:B=BS+(EA-SA)+1:GOS
       UB 920:SYS DEC("E9FB"):
       IF ST>0 THEN 800:ELSE 7
       90
XB 920 POKE193,FNLB(A):POKE194
       ,FNHB(A):POKE 174,FNLB(
       B):POKE 175,FNHB(B):RET
       URN
CP 930 CATALOG:PRINT"{DOWN}
       {BLU}** PRESS ANY KEY F
       OR MENU **":GETKEY A$:G
       OTO 220
MM 940 PRINT BE$"{RVS} QUIT
       {4}";RT$;"ARE YOU SURE
       {SPACE}[Y/N]?":GETKEY A
       $:IF A$<>"Y" THEN 220:E
       LSE PRINT"{CLR}":BANK 1
       5:END
JE 950 SOUND 1,500,10:RETURN
AF 960 IF ER=14 AND EL=260 THE
       N RESUME 300
MK 970 IF ER=14 AND EL=500 THE
       N RESUME NEXT
KJ 980 IF ER=4 AND EL=780 THEN
        F=4:A$=DS$:RESUME 800
DQ 990 IF ER=30 THEN RESUME:EL
       SE PRINT ERR$(ER);" ERR
       OR IN LINE";EL
```

Moon Rescue

Article on page 50.

```
AJ 10 GRAPHIC 1,1
FJ 20 COLOR4,12:COLOR0,1:COLOR
      1,2:GRAPHIC0,1:FORI=1TO4
      :MOVSPR I,0,0:NEXT
HS 30 CHAR1,14,8,"MOON RESCUE"
      :CHAR1,10,15,"MAKE NEW R
      OCKS (Y/N)"
FR 40 GETKEY A$:GRAPHIC1:FAST
AX 50 WIDTH2:DRAW 1,100,99TO10
      0,104:DRAW1,220,99TO220,
      104:WIDTH1:DRAW1,100,104
      TO100,107TO102,107TO102,
      104,104,102TO105,103,103
      ,101TO98,101,97,100TO97,
      99
JM 60 DRAW1,219,104TO219,107,2
      21,107TO221,104,224,101T
      O225,99,223,101TO218,101
      ,217,102TO216,103
EM 70 CIRCLE1,21,21,10,8:BOX1,
      14,26,28,29,0,1:PAINT1,2
      1,21
ME 80 DRAW1,15,30TO15,31,13,32
      TO17,32,27,28TO27,31,25,
      32TO29,32
CG 90 BOX0,11,10,14,16,0,1:BOX
      0,28,10,33,16,0,1:BOX0,1
      8,15,24,21:BOX0,18,24,20
      ,26:BOX0,24,24,22,26
JA 100 DRAW0,15,17TO15,26,27,1
       7TO27,26:WIDTH2:DRAW0,1
       8,28TO17,29,23,28TO24,2
       9
SA 110 DRAW0,12,21TO12,22,29,2
       1TO29,22:WIDTH1
CP 120 SSHAPEM1$,97,99,106,107
       :SSHAPEM2$,216,99,226,1
       07:SSHAPEE$,70,70,79,78
XK 130 SSHAPE LP$,9,12,32,32
HP 140 SSHAPEC$(1),9,10,22,32:
       SSHAPEC$(2),10,9,32,22
JR 150 GSHAPEE$,97,99:GSHAPEE$
       ,216,99:BOX0,9,12,32,32
       ,0,1
GE 160 IF A$<>"Y"THEN260
CG 170 FORW=1TO25:I=(INT(76*RN
       D(W))+45):X=INT(19*RND(
       W)+1)/2:Y=INT(20*RND(W)
       +1)/2:A=INT(360*RND(W)+
       1)
AB 180 CIRCLE1,100,100,X,Y,(36
       0-A),W,I:NEXTW:SSHAPEA$
       ,88,90,111,110
RE 190 FORS=1TO4:SPRSAVA$,S:SP
       RITES,1,9,0,0,0,1:SPRCO
       LOR1,11:NEXTS
CE 200 BOX0,88,90,111,110,0,1
BH 210 SCNCLR
SM 220 FORW=1TO15:X=INT(320*RN
       D(1))+1:Y=INT(75*RND(1)
       )+45:DRAW1,X,Y:NEXTW
EC 230 COLOR1,8:CIRCLE1,300,20
       ,15,15:PAINT1,300,20:BO
       X1,155,0,165,6,0,1:COLO
       R1,2:DRAW1,150,9TO160,1
       TO170,9
EX 240 COLOR1,6:DRAW1,0,150TO4
       0,150,40,150TO105,175,1
       05,175TO215,175,215,175
       TO280,150,280,150TO320,
       150:WIDTH2:PAINT1,1,151
       :WIDTH1
XG 250 PAINT 1,1,151:DRAW0,30,
       200TO105,175:DRAW0,215,
       175TO290,200
XD 260 COLOR1,2:CHAR1,15,24,"M
       OON RESCUE":SLOW
SR 270 CHAR1,0,0,"SAVED: 0
       {2 SPACES}LOST: 0{D}",1
CD 280 CHAR1,22,0,"{F}SET:0
       {3 SPACES}PROBE:0
       {2 SPACES}",1
PC 290 ML=4:MK=0:MS=0:P=3:L=1:
       S=0
XQ 300 FORS=1TO4:GOSUB740:MOVS
       PRS,100,((S*21)+68):NEX
       TS
HD 310 RESTORE:FORM=1TO4:READX
       H(M),YH(M):NEXTM
DE 320 FORW=1TO4:M$(W,1)=M1$:M
       $(W,2)=M2$:NEXTW:GOSUB4
       50:GOSUB480
HC 330 B=0:D=0:SP=0:J=0:MO=0:S
       PRSAV LP$,8
DG 340 MOVSPR8,173,58:SPRITE8,
       1,4,0,0,0,0
ER 350 IFML<1ANDMO=0ANDP>0THEN
       ML=4:L=L+1:GOSUB440:P=P
       +1:GOTO320
GE 360 GOSUB440:GOTO410
PG 370 IFSP<>1THEN410
HH 380 X=RSPPOS(8,0):IFX<24ORX
       >318THEN660
BR 390 Y=RSPPOS(8,1):IFY<66ORY
       >172THEN500
MB 400 B=BUMP(1):IFB>128ANDB<1
       44THEN660
EJ 410 J=JOY(2):IFJ=0THENJ=D:E
       LSEGOSUB720:IFJ=1ORJ=5T
       HEND=J:SP=1
PA 420 MOVSPR8,((J-1)*45)#SP:F
       ORW=1TO4:GSHAPEM$(W,M),
       XH(W),YH(W):NEXTW:M=M+1
       :GOSUB750:IFM>2THENM=1
JA 430 GOTO370
SM 440 CHAR1,6,0,STR$(MS),1:CH
       AR1,15,0,STR$(MK),1:CHA
       R1,27,0,STR$(L),1:CHAR1
       ,37,0,STR$(P),1:RETURN
RK 450 FORS=1TO4:D=90:SP=INT(4
       *RND(1))+1
KK 460 IFINT(S/2)=S/2THEND=270
DF 470 MOVSPRS,D#SP:NEXTS:RETU
       RN
KC 480 B=BUMP(1):IFB>0THEN480
FF 490 RETURN
KA 500 MOVSPR8,0#0:B=BUMP(1):I
       FB>128ANDB<144THEN660
BG 510 IFY>172THEN560
QM 520 IFD=5THENMOVSPR8,0#1:GO
       TO410
RD 530 IFX<160ORX>180THEN660
JS 540 GOSUB730:MOVSPR8,173,58
       :SP=0:D=0:IFMO=1THENMS=
       MS+1:MO=0:GOSUB480:GOSU
       B740
RH 550 GOTO350
BG 560 IF X<53THEN A=1:GOTO620
MH 570 IF X>302THENA=4:GOTO620
MK 580 IF Y<200THENMOVSPR8,0#1
       :GOTO410
GX 590 IF X>129ANDX<155THENA=2
       :GOTO630
GK 600 IF X>181ANDX<213THENA=3
       :GOTO630
HQ 610 GOTO660
MC 620 MOVSPR8,X,178:GOTO640
PA 630 MOVSPR8,X,202
CE 640 IFM$(A,1)<>E$ANDMO=0THE
       NM$(A,1)=E$:M$(A,2)=E$:
       MO=1:ML=ML-1:GOSUB740
RK 650 SLEEP1:GOSUB450:SP=0:D=
       0:GOTO350
KF 660 GOSUB760:P=P-1:MOVSPR8,
       0#0:SPRITE8,1,4,0,0,1,0
       :IFMO=1THENMK=MK+1:MO=0
```

```
SK 670 IFML<1ANDMO=0ANDP>0THEN
       ML=4:L=L+1:GOSUB440:P=P
       +1:GOTO320
SS 680 GOSUB440:FORW=1TO4:SPRS
       AVC$(W),8:NEXTW:SPRITE8
       ,0:GOSUB480
GK 690 IFP>0THENGOSUB440:GOTO3
       30
RX 700 FORS=1TO4:MOVSPRS,0#0:N
       EXTS:SLEEP3:RUN20
CM 710 DATA 20,140,125,165,180
       ,165,300,140
QM 720 SOUND2,54630,(S+5),1,27
       8,0,3,3119:RETURN
HX 730 SOUND1,6330,2,1,22376,1
       6585,1,756:RETURN
MQ 740 SOUND3,25911,2,1,3043,3
       640,0,3194:RETURN
SQ 750 SOUND1,885,(DU+2),1,120
       48,8021,3,1427:DU=0:RET
       URN
KR 760 DU=18:SOUND3,12000,10,2
       ,400,900,3:GOSUB750:RET
       URN
```

Sprite Locater

Article on page 72.

```
PM 100 POKE 53280,6:POKE 53281
       ,6:PRINT"{CLR}{WHT}
       {3 SPACES}READING DATA
SC 110 FOR I=832 TO 895:READ A
       :POKE I,A:NEXT
RM 120 FOR I=49152 TO 49486:RE
       AD A:POKE I,A:X=X+A:NEX
       T
PE 130 IF X<>41606 THEN PRINT"
       {CLR}{WHT}ERROR IN DATA
        STATEMENTS.":STOP
MR 140 SYS 49152
HM 150 REM{2 SPACES}SPRITE CRO
       SSHAIR DATA
JF 160 DATA 255,255,255,128,8,
       1,128,8,1,128,8,1,128,8
       ,1,128
DH 170 DATA 8,1,128,8,1,128,8,
       1,128,8,1,128,8,1,255,2
       55,255,128,8,1
RA 180 DATA 128,8,1,128,8,1,12
       8,8,1,128,8,1,128,8,1,1
       28,8,1,128,8
CG 190 DATA 1,128,8,1,255,255,
       255,0
PD 200 REM{2 SPACES}MAIN ROUTI
       NE DATA
QD 210 DATA 32,17,193,169,1,13
       3,255,32,44,193
SR 220 DATA 32,29,192,32,154,1
       92,32,228,255,240
JP 230 DATA 242,169,0,160,21,1
       53,0,208,96,173
XR 240 DATA 0,220,74,176,3,206
       ,1,208,74,176
EX 250 DATA 3,238,1,208,74,176
       ,38,173,0,208
QB 260 DATA 208,29,173,16,208,
       41,1,208,14,173
AA 270 DATA 16,208,9,1,141,16,
       208,169,80,141
AJ 280 DATA 0,208,96,173,16,20
       8,41,254,141,16
PM 290 DATA 208,206,0,208,96,7
       4,176,33,238,0
AF 300 DATA 208,240,52,169,80,
       205,0,208,208,53
JM 310 DATA 173,16,208,41,1,24
       0,46,173,16,208
PP 320 DATA 41,254,141,16,208,
       169,0,141,0,208
BJ 330 DATA 96,74,176,29,162,1
       12,160,255,32,48
AX 340 DATA 193,165,255,24,105
       ,1,201,16,48,2
SE 350 DATA 169,1,133,255,96,1
       73,16,208,9,1
AK 360 DATA 141,16,208,96,160,
       0,185,55,193,32
HG 370 DATA 210,255,200,192,3,
       208,245,173,0,208
RP 380 DATA 32,203,192,185,55,
       193,32,210,255,200
AK 390 DATA 192,6,208,245,173,
       1,208,32,203,192
EF 400 DATA 185,55,193,32,210,
       255,200,192,11,208
DD 410 DATA 245,165,255,141,66
       ,193,162,255,56,141
AM 420 DATA 66,193,233,100,232
       ,176,248,138,201,0
KB 430 DATA 208,6,32,12,193,76
       ,231,192,32,6
PC 440 DATA 193,173,66,193,162
       ,255,56,141,66,193
GF 450 DATA 233,10,232,176,248
       ,138,201,0,208,6
HA 460 DATA 32,12,193,76,3,193
       ,32,6,193,173
HK 470 DATA 66,193,24,105,48,7
       6,210,255,169,48
QC 480 DATA 76,210,255,160,0,1
       85,67,193,201,255
KR 490 DATA 240,12,170,200,185
       ,67,193,157,0,208
SS 500 DATA 200,76,19,193,169,
       13,141,248,7,96
HQ 510 DATA 166,255,160,0,136,
       208,253,202,208,250
BJ 520 DATA 96,19,88,61,32,89,
       61,32,83,80,68,61,0,0
QP 530 DATA 120,1,120,16,0,21,
       1,39,1,255,255,0,255,0,
       255,0
```

Sprite Graph

Article on page 84.

```
SJ 10 PRINT"{CLR}{WHT}
      {14 SPACES}SPRITE GRAPH
      {2 DOWN}"
EJ 20 INPUT"HOW MANY GRAPHS";B
      :F=1:IF B<1 THEN END
JS 30 OPEN3,4:PRINT#3,CHR$(14)
      "{2 SPACES}SPRITE GRAPH"
      :A=1:REM CHR$(14)-DOUBLE
       WIDTH MODE
CS 40 FORI=1TO24:PRINT#3:PRINT
      #3
EJ 50 PRINT#3,CHR$(15)"
      {5 SPACES}1{7 SPACES}1
      {7 SPACES}1":REM CHR$(15
      )-STANDARD CHAR MODE
FC 60 PRINT#3,CHR$(15)"
      {5 SPACES}2631{4 SPACES}
      2631{4 SPACES}2631"
FK 70 PRINT#3,CHR$(15)"
      {5 SPACES}84268421842684
      2184268421"CHR$(8):REM C
      HR$(8)-BIT IMAGE
XS 80 PRINT#3,CHR$(15)"
      {4 SPACES}[A][23 R][S]"C
      HR$(8)
SF 90 PRINT#3,CHR$(15)A;" [Q][+
      ++++++++++++++++++++++
      [W]"CHR$(8):A=A+1
SG 100 IF A>9 THEN 120
MR 110 GOTO 90
SJ 120 PRINT#3,CHR$(15)A;"[Q][+
      ++++++++++++++++++++++
      [W]"CHR$(8):A=A+1
BC 130 IF A=21 THEN 150
MM 140 GOTO 120
HM 150 PRINT#3,CHR$(15)" 21
      [Z][23 E][X]"CHR$(8)
AF 160 PRINT#3:PRINT F:F=F+1
RG 170 IF F<B+1 THEN A=1:GOTO
      {SPACE}40
SQ 180 CLOSE3:END
```

Pegs

Article on page 52.

Program 1: Pegs—64 Version

```
DR 10 DIMP(15),O(8),C(8),TC(14
      ,15),M$(36)
AR 20 BL$="":FORI=1TO39:BL$=BL
      $+" ":NEXT:DC=54272:C=64
      :P=49152:B=0:SP=32
CH 30 FORI=1TO15:READP(I):NEXT
BD 40 FORI=1TO8:READC(I):NEXT:
      FORI=1TO8:READO(I):NEXT
XR 50 FORI=1TO18:READM$(I)
KF 60 M$(I+18)=RIGHT$(M$(I),1)
      +MID$(M$(I),2,1)+LEFT$(M
      $(I),1):NEXT
XJ 70 FORI=PTOP+22:READD:POKEI
      ,D:NEXT
FK 80 PRINT"{CLR}{BLK}";:POKE5
      3280,6:POKE53281,15
RR 90 PRINT"{RVS}{BLU}
      {18 SPACES}PEGS
      {18 SPACES}{OFF}";
GH 100 SYSP,2,1:PRINT"{BLK}SCO
       RE:";S:FORI=1TO15:POKEP
       (I),I:POKEP(I)+DC,2
PQ 110 NEXT:FORI=2TO15:FORJ=1T
       O8:POKEP(I)+O(J),C(J):P
       OKEP(I)+O(J)+DC,B:NEXT:
       NEXT
PP 120 FORI=1TO8:POKEP(1)+O(I)
       +DC,B:POKEP(1)+O(I),SP:
       NEXT
HA 130 T=1:FORI=2TO15:TC(T,I)=
       1:NEXT:TC(T,1)=0:S=0
MP 140 SYSP,23,0:PRINTBL$:SYSP
       ,23,14:PRINT"YOUR MOVE"
       ;
BG 150 INPUTA$:IFT>1ANDA$="←"T
       HEN340
EQ 160 IFLEN(A$)<>2THEN310
XE 170 BM=1:FORI=1TO36:IFA$=LE
       FT$(M$(I),1)+RIGHT$(M$(
       I),1)THENBM=0:MC=I:I=36
MA 180 NEXT:IFBM>0THEN310
QM 190 MF=ASC(LEFT$(A$,1))-C:J
       P=ASC(MID$(M$(MC),2,1))
       -C:MT=ASC(RIGHT$(A$,1))
       -C
CH 200 IFTC(T,MF)=0ORTC(T,MT)=
       1ORTC(T,JP)=0THEN310
RB 210 FORI=1TO8:POKEP(MF)+O(I
       ),SP:POKEP(MT)+O(I),C(I
       ):NEXT
BA 220 FORI=1TO8:POKEP(JP)+O(I
       ),SP:NEXT:GOSUB460
GC 230 T=T+1:FORI=1TO15:TC(T,I
       )=TC(T-1,I):NEXT
FQ 240 TC(T,MF)=0:TC(T,MT)=1:T
       C(T,JP)=0:S=S+1
HH 250 SYSP,2,1:PRINT"SCORE:";
       S;"{LEFT} ":IFS=13THENG
       OTO440
FH 260 LC=0:FORI=1TO36:X=TC(T,
       ASC(LEFT$(M$(I),1))-C)
FS 270 Y=TC(T,ASC(MID$(M$(I),2
       ,1))-C):Z=TC(T,ASC(RIGH
       T$(M$(I),1))-C)
SF 280 IFX>0THENIFY>0THENIFZ=0
       THENLC=1:I=36
PC 290 NEXT:IFLC=0THEN380
```

```
RF 300 GOTO140
DG 310 SYSP,23,0:PRINTBL$:SYSP
       ,23,13:PRINT"ILLEGAL MO
       VE"
DM 320 FORI=1TO10:POKE54296,15
       :FORJ=1TO2:NEXT:POKE542
       96,0:FORJ=1TO2:NEXT:NEX
       T
MB 330 FORI=1TO250:NEXT:GOTO14
       0
DQ 340 T=T-1:S=S-1:FORI=1TO15
FD 350 IFTC(T,I)=0ANDTC(T+1,I)
       =1THENFORJ=1TO8:POKEP(I
       )+O(J),SP:NEXT
CC 360 IFTC(T,I)=1ANDTC(T+1,I)
       =0THENFORJ=1TO8:POKEP(I
       )+O(J),C(J):NEXT
FM 370 NEXT:GOTO250
XC 380 SYSP,23,0:PRINTBL$:SYSP
       ,23,6:PRINT"GAME OVER -
        YOUR SCORE IS";S
PM 390 FORI=0TO2100:NEXT
PP 400 SYSP,23,0:PRINTBL$:SYSP
       ,23,4:INPUT"PLAY AGAIN
       {SPACE}(Y/N) OR BACKUP
       {SPACE}(←)";A$
RM 410 IFLEFT$(A$,1)="Y"THENSY
       SP,2,1:PRINTBL$:S=0:GOT
       O100
AC 420 IFA$="←"THEN340
MC 430 PRINT"{CLR}":END
BH 440 SYSP,23,0:PRINTBL$:SYSP
       ,23,6:PRINT"CONGRATULAT
       IONS, YOU WON"
BB 450 FORI=1TO20:FORJ=1TO15:P
       OKE53280,J:NEXT:NEXT:PO
       KE53280,6:GOTO400
JS 460 POKEDC+24,15:POKEDC+1,1
       10:POKEDC+5,9:POKEDC+6,
       9:POKEDC+4,17:POKEDC+4,
       16
RE 470 RETURN
KQ 480 DATA 1203,1360,1366,151
       7,1523,1529,1674,1680
XD 490 DATA 1686,1692,1831,183
       7,1843,1849,1855
GB 500 DATA 85,64,73,66,75,64,
       74,66,-41,-40,-39,1,41,
       40,39,-1
MM 510 DATA ABD,ACF,BDG,BEI,CE
       H,CFJ,DEF,DGK,DHM
MF 520 DATA EHL,EIN,FIM,FJO,GH
       I,HIJ,KLM,LMN,MNO
SQ 530 DATA 32,13,192,132,251,
       32,13,192,166,251,76,24
       0
QQ 540 DATA 255,32,253,174,32,
       158,173,32,170,177,96
```

Program 2: Pegs—VIC Version

Note: An 8K or 16K expander is necessary to run this program.

```
DR 10 DIMP(15),O(8),C(8),TC(14
      ,15),M$(36)
PD 20 BL$="":FORI=1TO21:BL$=BL
      $+" ":NEXT:DC=33792:C=64
      :P=828:B=2:SP=32
CH 30 FORI=1TO15:READP(I):NEXT
BD 40 FORI=1TO8:READC(I):NEXT:
      FORI=1TO8:READO(I):NEXT
XR 50 FORI=1TO18:READM$(I)
KF 60 M$(I+18)=RIGHT$(M$(I),1)
      +MID$(M$(I),2,1)+LEFT$(M
      $(I),1):NEXT
MM 70 FORI=PTOP+15:READD:POKEI
      ,D:NEXT
HK 80 PRINT"{CLR}{BLK}";:POKE3
      6879,30
PM 90 PRINT"{RVS}{BLU}
      {9 SPACES}PEGS{9 SPACES}
      {OFF}";
HH 100 SYSP,2,0:PRINT"{BLK}SCO
       RE";S:FORI=1TO15:POKEP(
       I),I:POKEP(I)+DC,0
PQ 110 NEXT:FORI=2TO15:FORJ=1T
       O8:POKEP(I)+O(J),C(J):P
       OKEP(I)+O(J)+DC,B:NEXT:
       NEXT
PP 120 FORI=1TO8:POKEP(1)+O(I)
       +DC,B:POKEP(1)+O(I),SP:
       NEXT
HA 130 T=1:FORI=2TO15:TC(T,I)=
       1:NEXT:TC(T,1)=0:S=0
KX 140 SYSP,21,0:PRINTBL$:SYSP
       ,21,5:PRINT"YOUR MOVE";
AE 150 INPUTA$:IFT>1ANDA$="←"T
       HEN330
EQ 160 IFLEN(A$)<>2THEN310
XE 170 BM=1:FORI=1TO36:IFA$=LE
       FT$(M$(I),1)+RIGHT$(M$(
       I),1)THENBM=0:MC=I:I=36
MA 180 NEXT:IFBM>0THEN310
QM 190 MF=ASC(LEFT$(A$,1))-C:J
       P=ASC(MID$(M$(MC),2,1))
       -C:MT=ASC(RIGHT$(A$,1))
       -C
CH 200 IFTC(T,MF)=0ORTC(T,MT)=
       1ORTC(T,JP)=0THEN310
RB 210 FORI=1TO8:POKEP(MF)+O(I
       ),SP:POKEP(MT)+O(I),C(I
       ):NEXT
PF 220 FORI=1TO8:POKEP(JP)+O(I
       ),SP:NEXT:GOSUB480
GC 230 T=T+1:FORI=1TO15:TC(T,I
       )=TC(T-1,I):NEXT
FQ 240 TC(T,MF)=0:TC(T,MT)=1:T
       C(T,JP)=0:S=S+1
HD 250 SYSP,2,0:PRINT"SCORE";S
       ;"{LEFT} ":IFS=13THENGO
       TO460
FH 260 LC=0:FORI=1TO36:X=TC(T,
       ASC(LEFT$(M$(I),1))-C)
FS 270 Y=TC(T,ASC(MID$(M$(I),2
       ,1))-C):Z=TC(T,ASC(RIGH
       T$(M$(I),1))-C)
SF 280 IFX>0THENIFY>0THENIFZ=0
       THENLC=1:I=36
XD 290 NEXT:IFLC=0THEN370
RF 300 GOTO140
BC 310 SYSP,21,0:PRINTBL$:SYSP
       ,21,5:PRINT"ILLEGAL MOV
       E"
PG 320 POKE36878,15:POKE36874,
       129:FORTD=1TO600:NEXT:P
       OKE36878,0:POKE36874,0:
       GOTO140
HR 330 T=T-1:S=S-1:FORI=1TO15
KD 340 IFTC(T,I)=0ANDTC(T+1,I)
       =1THENFORJ=1TO8:POKEP(I
       )+O(J),SP:NEXT
GD 350 IFTC(T,I)=1ANDTC(T+1,I)
       =0THENFORJ=1TO8:POKEP(I
       )+O(J),C(J):NEXT
KF 360 NEXT:GOTO250
FB 370 SYSP,21,0:PRINTBL$:SYSP
       ,21,7:PRINT"GAME OVER":
       PRINT"{3 SPACES}YOUR SC
       ORE IS";S;
HM 380 FORI=0TO4100:NEXT
JP 390 SYSP,21,0:PRINTBL$:SYSP
       ,21,2:PRINT" PLAY AGAIN
        (Y/N)"
AM 400 PRINT"{4 SPACES}OR BACK
       UP (←)? {LEFT}";
DS 410 POKE198,0:WAIT198,1:GET
       A$
KM 420 IFA$="Y"THENS=0:GOTO80
SQ 430 IFA$="←"THENSYSP,22,0:P
       RINTBL$;:GOTO330
QX 440 IFA$<>"N"THEN410
CA 450 PRINT"{CLR}":END
JP 460 SYSP,21,0:PRINTBL$:SYSP
       ,21,6:PRINT"YOU WON"
RK 470 FOR Q1=1TO20:FORQ2=24TO
       30:POKE36879,Q2:NEXTQ2,
       Q1:GOTO390
KH 480 POKE36876,180:FORA=15TO
       0STEP-.3:POKE36878,A:NE
       XT:POKE36876,0:RETURN
RB 490 DATA 4150,4236,4240,432
       2,4326,4330,4408,4412,4
       416,4420
HD 500 DATA 4494,4498,4502,450
       6,4510
MK 510 DATA 85,64,73,72,75,64,
       74,66,-23,-22,-21,1,23,
       22,21,-1
SP 520 DATA ABD,ACF,BDG,BEI,CE
       H,CFJ,DEF,DGK,DHM
GE 530 DATA EHL,EIN,FIM,FJO,GH
       I,HIJ,KLM,LMN,MNO
SF 540 DATA 32,155,215,138,72,
       32,155,215,138,168,104,
       170,24,76,240,255
```

Program 3: Pegs—Plus/4 and 16 Version

```
HB 10 DIMP(15),O(8),C(8),TC(14
      ,15),M$(36):Z1=65305:Z2=
      65301
KH 20 BL$="":FORI=1TO39:BL$=BL
      $+" ":NEXT:DC=-1024:C=64
      :B=66:SP=32
CH 30 FORI=1TO15:READP(I):NEXT
BD 40 FORI=1TO8:READC(I):NEXT:
      FORI=1TO8:READO(I):NEXT
XR 50 FORI=1TO18:READM$(I)
KF 60 M$(I+18)=RIGHT$(M$(I),1)
      +MID$(M$(I),2,1)+LEFT$(M
      $(I),1):NEXT
MP 70 PRINT"{CLR}{BLK}";:POKEZ
      1,70
AQ 80 PRINT"{RVS}{BLU}
      {18 SPACES}PEGS
      {18 SPACES}{OFF}";
DD 90 CHAR 1,1,2,"":PRINT"
      {BLK}SCORE:";S:FORI=1TO1
      5:POKEP(I),I:POKEP(I)+DC
      ,0
HQ 100 NEXT:FORI=2TO15:FORJ=1T
       O8:POKEP(I)+O(J),C(J):P
       OKEP(I)+O(J)+DC,B:NEXT:
       NEXT
XM 110 FORI=1TO8:POKEP(1)+O(I)
       +DC,B:POKEP(1)+O(I),SP:
       NEXT
CX 120 T=1:FORI=2TO15:TC(T,I)=
       1:NEXT:TC(T,1)=0:S=0
SA 130 CHAR 1,0,23,"":PRINTBL$
       :CHAR1,14,23,"":PRINT"Y
       OUR MOVE";
JH 140 INPUTA$:IFT>1ANDA$="-"T
       HEN330
FS 150 IFLEN(A$)<>2THEN300
PH 160 BM=1:FORI=1TO36:IFA$=LE
       FT$(M$(I),1)+RIGHT$(M$(
       I),1)THENBM=0:MC=I:I=36
MC 170 NEXT:IFBM>0THEN300
JR 180 MF=ASC(LEFT$(A$,1))-C:J
       P=ASC(MID$(M$(MC),2,1))
       -C:MT=ASC(RIGHT$(A$,1))
       -C
JF 190 IFTC(T,MF)=0ORTC(T,MT)=
       1ORTC(T,JP)=0THEN300
BB 200 FORI=1TO8:POKEP(MF)+O(I
       ),SP:POKEP(MT)+O(I),C(I
       ):NEXT
KQ 210 FORI=1TO8:POKEP(JP)+O(I
       ),SP:NEXT:GOSUB450
```

```
MF 220 T=T+1:FORI=1TO15:TC(T,I
       )=TC(T-1,I):NEXT
KR 230 TC(T,MF)=0:TC(T,MT)=1:T
       C(T,JP)=0:S=S+1
SX 240 CHAR1,1,2,"":PRINT"SCOR
       E:";S;"{LEFT} ":IFS=13T
       HENGOTO430
KH 250 LC=0:FORI=1TO36:X=TC(T,
       ASC(LEFT$(M$(I),1))-C)
KS 260 Y=TC(T,ASC(MID$(M$(I),2
       ,1))-C):Z=TC(T,ASC(RIGH
       T$(M$(I),1))-C)
ME 270 IFX>0THENIFY>0THENIFZ=0
       THENLC=1:I=36
QQ 280 NEXT:IFLC=0THEN370
XF 290 GOTO130
EJ 300 CHAR 1,0,23,"":PRINTBL$
       :CHAR1,13,23,"":PRINT"I
       LLEGAL MOVE"
KE 310 VOL8:SOUND 1,0,20
AD 320 FORI=1TO250:NEXT:GOTO13
       0
HR 330 T=T-1:S=S-1:FORI=1TO15
KD 340 IFTC(T,I)=0ANDTC(T+1,I)
       =1THENFORJ=1TO8:POKEP(I
       )+O(J),SP:NEXT
GD 350 IFTC(T,I)=1ANDTC(T+1,I)
       =0THENFORJ=1TO8:POKEP(I
       )+O(J),C(J):NEXT
PE 360 NEXT:GOTO240
GK 370 CHAR1,0,23,"":PRINTBL$:
       CHAR 1,6,23,"":PRINT"GA
       ME OVER - YOUR SCORE IS
       ";S
XP 380 FORI=0TO2100:NEXT
JF 390 CHAR1,0,23,"":PRINTBL$:
       CHAR1,4,23,"":INPUT"PLA
       Y AGAIN (Y/N) OR BACKUP
       (-)";A$
AE 400 IFLEFT$(A$,1)="Y"THENCH
       AR1,1,2,"":PRINTBL$:S=0
       :GOTO70
SR 410 IFA$="-"THEN330
XR 420 PRINT"{CLR}":END
GS 430 CHAR 1,0,23,"":PRINTBL$
       :CHAR 1,6,23,"":PRINT"C
       ONGRATULATIONS, YOU WON
       "
DP 440 FORI=1TO20:FORJ=1TO15:P
       OKEZ1,J+80:NEXT:NEXT:PO
       KEZ1,70:GOTO390
ES 450 SOUND 1,960,30:FOR A=8
       {SPACE}TO 1 STEP-.2:VOL
       A:NEXT
KD 460 RETURN
XQ 470 DATA 3251,3408,3414,356
       5,3571,3577,3722,3728
GJ 480 DATA 3734,3740,3879,388
       5,3891,3897,3903
RB 490 DATA 85,64,73,66,75,64,
       74,66,-41,-40,-39,1,41,
       40,39,-1
GM 500 DATA ABD,ACF,BDG,BEI,CE
       H,CFJ,DEF,DGK,DHM
SG 510 DATA EHL,EIN,FIM,FJO,GH
       I,HIJ,KLM,LMN,MNO
```

Q-Bird

See instructions in article on page 46 before typing in.

```
0801:0B 08 00 00 9E 32 30 36 EC
0809:31 00 00 00 A9 00 8D 20 3A
0811:D0 20 CF 14 20 1B 08 4C 96
0819:C7 0B A9 93 20 D2 FF A9 34
0821:08 20 D2 FF A9 8E 20 D2 32
0829:FF A9 04 85 02 A9 0E 38 87
0831:E5 02 EA EA 85 D3 A5 02 89
0839:85 D6 20 10 E5 A0 06 A2 27
0841:0E BD 63 08 20 D2 FF CA CB
0849:10 F7 88 10 F2 A9 0D 20 E9
0851:D2 FF 20 D2 FF E6 02 E6 82
0859:02 A5 02 C9 10 D0 CE 4C 5E
0861:73 08 1D 91 B7 B7 98 9D 55
0869:9D 9D 11 A9 92 20 A9 12 E6
0871:05 00 A0 09 A9 00 85 02 03
0879:A6 02 BD B0 08 C9 FF F0 78
0881:08 20 D2 FF E6 02 4C 79 49
0889:08 88 10 03 4C C6 13 E8 7E
0891:E6 02 BD B0 08 85 D3 E8 3F
0899:E6 02 BD B0 08 85 D6 48 AC
08A1:8A 48 98 48 20 10 E5 68 16
08A9:A8 68 AA 68 4C 85 08 FF 8C
08B1:21 05 1C 1F 1F 1F 1F 1F DB
08B9:1F FF 21 06 1F 1F 1F 1F B0
08C1:1F 1F FF 23 08 1F 1F 1F 75
08C9:FF 22 0A FF 21 0C 1F 91 AC
08D1:91 91 51 2D 42 49 52 44 2C
08D9:FF 04 11 1E 48 49 53 43 40
08E1:4F 52 45 3A 99 30 30 30 98
08E9:30 30 FF 05 13 1E 53 43 69
08F1:4F 52 45 3A 99 30 30 30 A8
08F9:30 30 FF 19 11 1E 4C 45 9E
0901:56 45 4C 3A 99 30 31 FF AC
0909:19 13 1E 4C 49 56 45 53 76
0911:3A 99 FF A9 97 20 D2 FF 24
0919:A0 02 A9 A4 20 31 09 A0 F3
0921:10 A9 A3 20 31 09 A0 14 1F
0929:A9 A4 20 31 09 4C 45 09 5D
0931:84 D6 A0 00 84 D3 48 20 73
0939:10 E5 68 A2 26 20 D2 FF 5B
0941:CA 10 FA 60 A9 1F 85 D3 CA
0949:A9 03 85 D6 20 10 E5 A2 BE
0951:0C A9 A7 20 D2 FF A9 9D 52
0959:20 D2 FF A9 11 20 D2 FF 79
0961:CA 10 EE 60 00 00 A9 FF 14
0969:8D 1C D0 A9 00 8D 15 D0 2F
0971:8D 1D D0 8D 17 D0 A9 07 DA
0979:8D 25 D0 4C 80 0B 00 03 AD
0981:C0 00 0E B0 F0 3A AF AC 3D
0989:36 6A AC D6 AA B0 3A AA 8B
0991:B0 0E AA C0 03 67 00 03 99
0999:77 00 0D DD C0 03 33 00 5F
09A1:00 00 00 00 00 00 00 00 B3
09A9:00 00 00 00 00 00 00 00 BB
09B1:00 00 00 00 00 00 00 00 C3
09B9:00 00 00 00 00 00 00 03 CE
09C1:C3 00 0E BE F0 3A AA EC 16
09C9:D6 6B AC 36 AB B0 DA AE 9F
09D1:B0 3E AA C0 03 67 00 03 E5
09D9:77 00 03 77 00 0D DD C0 30
09E1:03 33 00 00 00 00 00 00 42
09E9:00 00 00 00 00 00 00 00 FB
09F1:00 00 00 00 00 00 00 00 04
09F9:00 00 00 00 00 00 00 00 0C
0A01:0F 00 3C 3A C0 EB EA B0 04
0A09:EA A6 70 3A AA 5C 3A AA D3
0A11:B0 0E AA C0 03 67 00 03 1B
0A19:77 00 0D DD C0 03 33 00 E0
0A21:00 00 00 00 00 00 00 00 35
0A29:00 00 00 00 00 00 00 00 3D
0A31:00 00 00 00 00 00 00 00 45
0A39:00 00 00 00 00 00 00 03 50
0A41:0F 00 3E FA C0 EE AA B0 1C
0A49:EB A6 5C 3B AA 70 3A EA B2
0A51:9C 0E AA F0 03 67 00 03 54
0A59:77 00 03 77 00 0D DD C0 B1
0A61:03 33 00 00 00 00 00 00 C3
0A69:00 00 00 00 00 00 00 00 7D
0A71:00 00 00 00 00 00 00 00 85
0A79:00 00 00 00 00 00 00 03 90
0A81:C0 00 0E B0 00 36 6C 00 74
0A89:EA AC 00 FE AC 00 EA AC 16
0A91:00 3E B0 00 EA AC 00 35 8A
0A99:AC 00 0D AC 00 0D AC 00 FD
0AA1:0D AC 00 3A AC 00 EA B0 F6
0AA9:00 3E B0 00 0E B0 00 03 99
0AB1:AC 00 00 F0 00 00 00 00 2B
0AB9:00 00 00 00 00 00 00 03 D0
0AC1:C0 00 0E B0 00 36 6C 00 B4
0AC9:EA AC 00 EA AC 00 3A B0 B7
0AD1:00 0E AC 00 3A AC 00 E5 69
0AD9:AC 00 3D AC 00 0D AC 00 44
0AE1:0D AC 00 3A B0 00 EA B0 57
0AE9:00 EE B0 00 3E B0 00 03 87
0AF1:B0 00 00 C0 00 00 00 00 6A
0AF9:00 00 00 00 00 00 00 0F 1D
0B01:00 00 3A C0 00 E6 70 00 E6
0B09:EA AC 00 EA FC 00 EA AC D8
0B11:00 3A F0 00 EA AC 00 E9 C7
0B19:70 00 E9 C0 00 E9 C0 00 D9
0B21:E9 C0 00 EA B0 00 3A AC B1
0B29:00 3A F0 00 3A C0 00 EB AC
0B31:00 00 3C 00 00 00 00 00 CE
0B39:00 00 00 00 00 00 00 0F 5E
0B41:00 00 3A C0 00 E6 70 00 27
0B49:EA AC 00 EA AC 00 3A B0 39
0B51:00 EA C0 00 EA B0 00 E9 3E
0B59:6C 00 E9 F0 00 E9 C0 00 1B
0B61:E9 C0 00 3A B0 00 3A AC E6
0B69:00 3A EC 00 3A F0 00 3B 7C
0B71:00 00 0C 00 00 00 00 00 09
0B79:00 00 00 00 00 00 00 A9 39
0B81:00 8D 26 D0 A2 07 BD 99 13
0B89:0B 9D 27 D0 BD A1 0B 9D A6
0B91:F8 07 CA 10 F1 4C A9 0B 5F
0B99:05 04 04 04 09 02 06 0E 5E
0BA1:80 2C 2A 2C 3E 3C 26 82 BC
0BA9:A2 0F BD B7 0B 9D 00 D0 A7
0BB1:CA 10 F7 60 00 00 78 66 8D
0BB9:6D 47 FD 47 1D 97 00 00 D3
0BC1:00 00 A9 9E 00 00 20 67 9E
0BC9:09 4C A0 12 4C 55 19 AD 44
0BD1:34 03 C9 07 D0 0F A9 00 82
0BD9:8D 34 03 EE 35 03 AD 35 59
0BE1:03 C9 05 F0 03 4C 08 16 0B
0BE9:20 3A 0C C9 00 F0 03 4C D2
0BF1:C4 11 20 DB 11 29 0F 49 05
0BF9:0F 85 03 29 01 C9 01 D0 ED
0C01:08 A9 00 8D 66 0C 4C 97 F3
0C09:0C A5 03 29 02 C9 02 D0 8F
0C11:08 A9 20 8D 66 0C 4C 97 08
0C19:0C A5 03 29 04 C9 04 D0 B3
0C21:08 A9 40 8D 66 0C 4C 97 1C
0C29:0C A5 03 29 08 C9 08 D0 EB
0C31:B4 A9 60 8D 66 0C 4C 97 86
0C39:0C A9 00 8D 35 03 AD 36 E1
0C41:03 60 8D 21 D0 A9 00 A2 86
0C49:CB 9D 34 03 CA E0 FF D0 10
0C51:F8 60 EE 36 03 AE 36 03 81
0C59:E0 1A D0 08 A9 00 8D 36 A1
0C61:03 4C 46 16 BD 20 0D AA 6B
0C69:BD 80 0C 18 6D 0C D0 8D 4E
0C71:0C D0 BD 8B 0C 18 6D 0D DC
0C79:D0 8D 0D D0 4C 04 18 00 AE
0C81:00 00 00 FF FF FF 00 01 9A
0C89:01 01 00 FF 01 00 00 FF 6A
0C91:01 00 00 FF 01 00 AD 66 F3
0C99:0C C9 00 F0 0C C9 60 F0 72
0CA1:08 A9 27 8D FE 07 4C 53 E5
0CA9:0C A9 29 8D FE 07 4C 53 30
0CB1:0C CE FE 07 4C E6 0B A9 91
0CB9:04 85 FE A0 00 84 FD A2 CF
0CC1:04 AD 3A 03 18 65 FD 85 96
0CC9:FD A5 FE 69 00 85 FE CA 9F
0CD1:10 EF A5 FD 18 6D 3B 03 72
0CD9:85 FD A5 FE 69 00 85 FE 2E
0CE1:60 00 00 AD 0D D0 38 E9 0B
0CE9:31 8D 3A 03 AD 0C D0 4A FE
0CF1:4A 4A 18 69 0C 8D 3B 03 6B
0CF9:20 B8 0C 4C 99 0D 00 00 97
0D01:01 01 01 01 01 01 01 01 1B
0D09:09 09 09 09 09 09 09 09 23
0D11:08 08 08 08 08 08 08 08 2B
0D19:00 00 00 00 00 00 00 00 33
0D21:04 04 04 04 04 04 04 04 3B
0D29:06 06 06 06 06 06 06 06 43
0D31:02 02 02 02 02 02 02 02 4B
0D39:00 00 00 00 00 00 00 00 53
0D41:05 05 05 05 05 05 05 05 5B
0D49:04 04 04 04 04 04 04 04 63
0D51:06 06 06 06 06 06 06 06 6B
0D59:00 00 00 00 00 00 00 00 73
0D61:09 09 09 09 09 09 09 09 7B
0D69:08 08 08 08 08 08 08 08 83
```

```
0D71:0A 0A 0A 0A 0A 0A 0A 0A 8B
0D79:00 00 00 00 00 00 00 A5 39
0D81:FE 18 69 D4 85 FE A0 02 07
0D89:B1 FD 4C 68 12 20 30 17 94
0D91:91 FD 88 10 F3 4C B2 0C 48
0D99:B1 FD C9 E9 F0 E1 4C 78 04
0DA1:14 EE 37 03 AD 37 03 C9 B2
0DA9:02 D0 2C A9 00 8D 37 03 C0
0DB1:EE 38 03 AD 38 03 C9 01 EE
0DB9:D0 1D A9 00 8D 38 03 A2 AE
0DC1:01 FE 3C 03 BD 3C 03 DD 96
0DC9:DB 0D D0 08 A9 00 9D 3C 74
0DD1:03 20 00 0E 4C E5 0E 60 CC
0DD9:2E 11 18 18 1C 20 00 00 35
0DE1:00 A2 18 A9 00 9D 00 D4 8D
0DE9:CA 10 FA A9 FF 8D 0F D4 90
0DF1:A9 80 8D 12 D4 A9 00 4C 6D
0DF9:AE 17 00 00 00 00 00 BD EE
0E01:40 03 C9 00 D0 0D 20 81 B3
0E09:0E 29 03 0A 0A 0A 0A 0A 0E
0E11:20 54 0E BD 50 03 8D 6E 08
0E19:0E FE 40 03 BC 40 03 C0 E1
0E21:1E D0 09 A9 00 9D 40 03 36
0E29:EA EA EA 60 86 05 06 05 32
0E31:8E 4F 03 EA 20 6D 0E AA F4
0E39:A4 05 BD 80 0C 18 79 00 5C
0E41:D0 99 00 D0 BD 8B 0C 18 85
0E49:79 01 D0 99 01 D0 AE 4F 0E
0E51:03 60 00 9D 50 03 C9 00 03
0E59:F0 0A C9 60 F0 06 A9 2B CD
0E61:9D F8 07 60 A9 2D 9D F8 A7
0E69:07 60 00 00 B9 60 0D C9 54
0E71:00 D0 0A 48 BD F8 07 29 90
0E79:FE 9D F8 07 68 60 00 00 D0
0E81:EA EA EA 20 DC 0E AD 3A E1
0E89:03 38 E9 2C 8D 3A 03 AD 3E
0E91:3B 03 4A 4A 4A 18 69 0C 8B
0E99:8D 3B 03 86 FC 20 B8 0C F9
0EA1:A6 FC A0 00 B1 FD C9 E9 67
0EA9:D0 D9 AD FF 03 60 00 86 7A
0EB1:05 20 D5 17 29 03 8D FF F4
0EB9:03 AA BD D4 0E 18 79 01 CB
0EC1:D0 8D 3A 03 BD D8 0E 18 A6
0EC9:79 00 D0 8D 3B 03 A6 05 CD
0ED1:60 00 00 F2 12 02 02 12 FB
0ED9:F2 EA 1A 86 05 06 05 A4 C4
0EE1:05 4C B0 0E E8 E0 04 F0 4E
0EE9:03 4C C2 0D 4C D8 0D A2 46
0EF1:BF BD 00 10 9D 00 20 CA 56
0EF9:E0 FF D0 F5 4C E2 0D 00 08
0F01:FC 00 03 AB 00 0E 5A C0 66
0F09:39 AA B0 3A AA B0 EA A9 BF
0F11:AC EA AA AC EA AA AC 39 F4
0F19:AA B0 39 69 B0 0E 56 C0 A1
0F21:03 AB 00 00 FC 00 00 00 93
0F29:00 00 00 00 00 00 00 00 47
0F31:00 00 00 00 00 00 00 00 4F
0F39:00 00 00 00 00 00 00 00 57
0F41:FC 00 03 AB 00 0E 96 C0 1F
0F49:3A A9 B0 3A AA B0 EA AA 41
0F51:AC EA AA AC EA AA AC 39 35
0F59:AA B0 39 6A B0 0E 5A C0 F9
0F61:03 AB 00 00 FC 00 00 00 D3
0F69:00 00 00 00 00 00 00 00 87
0F71:00 00 00 00 00 00 00 00 8F
0F79:00 00 00 00 00 00 00 00 97
0F81:00 00 00 00 00 00 00 00 9F
0F89:03 F3 FC 3E AE AB EF FA A8
0F91:65 EA AA A9 EA EA AF 3F AE
0F99:AA F0 3A AF 00 0F F0 00 A9
0FA1:00 00 00 00 00 00 00 00 BF
0FA9:00 00 00 00 00 00 00 00 C7
0FB1:00 00 00 00 00 00 00 00 CF
0FB9:00 00 00 00 00 00 00 00 D7
0FC1:00 00 00 00 00 0F C0 00 9D
0FC9:3A BC 00 0E AB FC 3F AE 93
0FD1:AB EF FA 65 EA AA A9 EA B7
0FD9:EA AF 3F AA F0 0E AB 00 03
0FE1:0E AC 00 3A F0 00 0F 00 7B
0FE9:00 00 00 00 00 00 00 00 08
0FF1:00 00 00 00 00 00 00 00 10
0FF9:00 00 00 00 00 00 00 00 18
1001:00 00 00 FC 00 03 AB 00 54
1009:0E 66 C0 3E AA F0 35 A9 F2
1011:70 35 99 70 0D 55 C0 03 33
1019:57 00 03 9B 00 03 AB 00 62
1021:0E 6C 00 0E AF C0 39 BE F5
1029:B0 3A BA C0 39 BE B0 0E C7
1031:AA B0 0E 6A C0 03 AB 00 A4
1039:00 FC 00 00 00 00 00 03 9B
1041:FF 00 0E 66 C0 3A AA B0 7E
1049:35 99 70 35 55 70 0D 55 A7
1051:C0 03 57 00 03 9B 00 03 07
1059:9B 00 03 AB 00 03 9B 00 A5
1061:0E AC 00 0E 6C 00 0E AC C0
1069:00 0E 6C 00 0E AC 00 03 C0
1071:6B 00 03 AB 00 03 9B 00 A5
1079:00 EA C0 00 3F 00 00 00 66
1081:00 00 00 00 00 00 30 00 02
1089:00 EC 00 03 AB 00 03 6B E3
1091:00 03 6B 00 03 5B 00 03 68
1099:9B 00 00 FC 00 00 00 00 57
10A1:00 00 00 00 00 00 00 00 C1
10A9:00 00 00 00 00 00 00 00 C9
10B1:00 00 00 00 00 00 00 00 D1
10B9:00 00 00 00 00 00 00 AD 87
10C1:01 D0 18 69 08 38 ED F6 24
10C9:03 F0 08 90 03 A9 00 60 D0
10D1:A9 20 60 AD 00 D0 18 69 92
10D9:02 38 ED F5 03 90 03 A9 30
10E1:40 60 A9 60 60 00 00 AD 26
10E9:F0 03 C9 00 D0 06 20 4F AA
10F1:11 8D 00 11 EE F0 03 AE FE
10F9:F0 03 E0 20 F0 27 BD 20 31
1101:0D AA C9 00 D0 08 AD F8 88
1109:07 29 80 8D F8 07 BD 80 C1
1111:0C 18 6D 00 D0 8D 00 D0 7A
1119:BD 8B 0C 18 6D 01 D0 8D 9E
1121:01 D0 4C 69 11 A9 00 8D D4
1129:F0 03 4C 23 11 EE F1 03 6B
1131:AD F1 03 C9 0A D0 EB A9 B8
1139:00 8D F1 03 EE F2 03 AD 24
1141:F2 03 C9 05 D0 DC A9 00 74
1149:8D F2 03 4C E8 10 A9 81 70
1151:8D F8 07 4C C0 10 AD 0C CB
1159:D0 8D F5 03 AD 0D D0 8D 07
1161:F6 03 AD 00 DC 60 00 00 DD
1169:EE FA 03 AD FA 03 C9 06 7A
1171:D0 0F A9 00 8D FA 03 EE 42
1179:FB 03 AD FB 03 C9 05 F0 0A
1181:28 4C ED 11 A9 00 8D FB FD
1189:03 EE 08 D0 AD 08 D0 C9 EF
1191:01 D0 EE 20 D5 17 29 07 AC
1199:C9 06 B0 F7 0A 0A 0A 0A 4E
11A1:18 69 4C 8D 09 D0 4C 82 33
11A9:11 EE FC 03 AD FC 03 C9 11
11B1:20 D0 D1 AD FC 07 49 01 C4
11B9:8D FC 07 A9 00 8D FC 03 90
11C1:4C 85 11 AD FE 03 C9 01 01
11C9:F0 03 4C 53 0C EE FD 03 FE
11D1:AD FD 03 29 01 F0 F3 4C 3D
11D9:56 0C A9 00 8D FE 03 AD 7B
11E1:00 DC 29 10 D0 03 EE FE D0
11E9:03 4C 57 11 EE F3 03 AD 97
11F1:F3 03 C9 05 D0 0F A9 00 6E
11F9:8D F3 03 EE F4 03 AD F4 33
1201:03 C9 0A F0 03 4C CD 0B 59
1209:A9 00 8D F4 03 EE 0B D0 BD
1211:4C 3D 12 C9 01 F0 0A C9 33
1219:48 90 03 20 4C 12 4C 06 31
1221:12 20 D5 17 29 07 C9 07 82
1229:B0 F7 AA A9 00 18 69 18 DE
1231:CA 10 FA 18 69 58 8D 0A 71
1239:D0 4C 1C 12 AD 0B D0 C9 82
1241:A8 D0 D0 A9 01 8D 0B D0 C7
1249:4C 22 12 CE 0A D0 EE EF AC
1251:03 AD EF 03 C9 08 D0 0D AD
1259:AD FD 07 49 01 8D FD 07 8A
1261:A9 00 8D EF 03 60 00 29 CD
1269:0F C9 02 D0 03 4C 96 0D 58
1271:85 04 E6 04 C9 01 EA D0 6F
1279:0D EE D0 03 AD D0 03 C9 AA
1281:7E D0 03 4C 8A 12 4C 8E 02
1289:0D A5 04 91 FD 4C 47 17 FD
1291:AD E1 03 8D 76 12 8D 6B C0
1299:12 4C B7 13 60 00 00 A9 AE
12A1:06 85 D3 A9 16 85 D6 20 D3
12A9:10 E5 A2 00 BD BB 12 20 C4
12B1:D2 FF E8 E0 3D D0 F5 4C CF
12B9:6A 15 08 8E 9E 55 53 45 78
12C1:20 53 54 49 43 4B 20 54 C5
12C9:4F 20 53 45 4C 45 43 54 AE
12D1:20 4C 45 56 45 4C 0D 20 BC
12D9:00 00 00 20 20 20 20 20 E1
12E1:20 50 52 45 53 53 20 54 45
12E9:52 49 47 47 45 52 20 54 EE
12F1:4F 20 53 54 41 52 54 00 71
12F9:00 20 77 15 29 10 D0 0B 9C
1301:20 72 13 A9 40 8D 15 D0 04
1309:4C 5B 17 AD 00 DC 29 0F BE
1311:49 0F 29 03 C9 01 D0 0D F5
1319:AD E1 03 C9 0F F0 DA EE 6C
1321:E1 03 4C 34 13 C9 02 D0 5A
1329:D0 AD E1 03 C9 02 90 C9 D0
1331:CE E1 03 AD E1 03 C9 0A 2B
1339:B0 0E 18 69 30 8D C8 06 24
1341:A9 30 8D C7 06 4C FA 12 DF
1349:18 69 26 8D C8 06 A9 31 56
1351:8D C7 06 4C FA 12 00 EE C4
1359:E3 03 D0 FB EE E4 03 AD CA
1361:E4 03 C9 FF D0 F6 A9 08 B1
1369:8D E4 03 AD 00 DC 60 00 FE
1371:00 A2 27 A9 20 9D 70 07 1F
1379:9D 98 07 CA 10 F7 60 00 43
1381:00 20 91 12 4C A7 13 EE 19
1389:E3 03 D0 FB EE E4 03 D0 1E
1391:F6 EE E5 03 AD E5 03 C9 B0
1399:02 D0 EC A9 00 8D E5 03 32
13A1:8D 15 D0 4C D3 13 AD E1 DA
13A9:03 C9 00 D0 03 EE E1 03 6B
13B1:20 91 12 4C E0 13 EE 6B EF
13B9:12 C9 0F D0 05 A9 00 8D A6
13C1:6B 12 60 00 00 A9 30 20 55
13C9:D2 FF A9 35 20 D2 FF 4C 7A
13D1:14 09 20 1B 08 AD E1 03 B7
13D9:C9 0F F0 03 EE E1 03 A9 A5
13E1:60 8D 46 13 8D 54 13 20 99
13E9:34 13 A9 4C 8D 46 13 8D 22
13F1:54 13 20 17 14 20 E4 16 7D
13F9:A9 FF 8D 15 D0 AD E1 03 FB
1401:85 04 A9 00 A2 CB 9D 34 D5
1409:03 CA E0 FF D0 F8 A5 04 3B
1411:8D E1 03 4C 91 15 A9 0E DF
1419:85 D3 A9 16 85 D6 20 23 7A
1421:15 A2 00 20 4C 14 E8 E0 E3
1429:0B D0 F8 A9 60 8D A1 13 54
1431:20 88 13 A9 8D 8D A1 13 81
1439:20 DC 14 4C 91 12 9E 47 49
1441:45 54 20 52 45 41 44 59 5B
1449:00 00 00 BD 3F 14 4C D2 03
1451:FF EE D4 03 D0 FB EE D5 2A
1459:03 AD D5 03 C9 03 D0 F1 47
1461:A9 00 8D D5 03 20 3A 18 92
1469:AD 0D D0 C9 FF D0 E2 A9 15
1471:00 8D 1B D0 4C 9D 14 A9 18
1479:40 8D 1B D0 4C 52 14 8D F6
1481:15 D0 AD D0 03 85 FC A9 FC
1489:60 8D 14 14 20 E0 13 A9 5D
1491:4C 8D 14 14 A5 FC 8D D0 14
1499:03 4C CD 0B 8D 15 D0 AD D0
14A1:18 07 C9 30 D0 15 AD 17 21
14A9:07 C9 30 D0 03 4C 29 15 8B
14B1:A9 39 8D 18 07 CE 17 07 D8
14B9:4C BF 14 CE 18 07 20 8D 12
14C1:19 8D C7 13 AD 18 07 8D 6D
14C9:CC 13 4C 83 14 00 A9 30 03
14D1:8D C7 13 A9 35 8D CC 13 3C
14D9:4C F0 0E A9 0C 85 D3 A9 88
14E1:16 85 D6 20 10 E5 A2 00 B0
14E9:BD F7 14 20 D2 FF E8 E0 BC
14F1:17 D0 F5 4C 10 15 05 43 7F
14F9:48 41 4E 47 45 20 54 4F 77
1501:20 12 E9 20 92 E9 11 9D FA
1509:9D 9D 98 B7 B7 00 00 AD 63
1511:E1 03 18 69 01 8D 86 DB AD
1519:8D 87 DB 8D 88 DB 60 00 B4
1521:00 00 20 72 13 4C 10 E5 46
1529:20 72 13 A9 0E 85 D3 A9 D4
1531:16 85 D6 20 10 E5 A2 00 02
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1539:BD 5E 15 20 D2 FF E8 E0 C7
1541:0A D0 F5 EE D7 03 D0 FB BA
1549:EE D8 03 D0 F6 EE D9 03 B8
1551:AD D9 03 C9 05 D0 EC A2 AD
1559:00 9A 4C 0D 08 9F 47 41 13
1561:4D 45 20 4F 56 45 52 00 E8
1569:00 A9 0E 8D 15 D0 A9 60 38
1571:8D D8 0D 4C FA 12 20 A2 02
1579:0D EE EC 03 D0 F8 EE ED E9
1581:03 AD ED 03 C9 09 D0 EE 89
1589:A9 00 8D ED 03 4C 5D 13 30
1591:A9 4C 8D D8 0D A9 10 38 4A
1599:ED E1 03 4A 8D AE 15 EE 78
15A1:AE 15 4C CD 0B 00 EE C1 C6
15A9:03 AD C1 03 C9 08 D0 F6 30
15B1:A9 00 8D C1 03 EE 34 03 BD
15B9:4C D0 0B 20 44 19 29 F8 73
15C1:18 69 06 8D 0D 50 20 D5 AB
15C9:17 29 F8 18 69 01 8D 0C E0
15D1:50 20 E4 0C A0 00 B1 FD EF
15D9:C9 E9 D0 DF AD 0C 50 8D 47
15E1:0E D0 AD 0D 50 8D 0F D0 75
15E9:A9 4C 8D FC 0C 4C F9 15 18
15F1:A9 60 8D FC 0C 4C 3B 16 A8
15F9:A9 D0 8D EF 0C 8D E6 0C 4E
1601:4C CD 0B 00 00 00 00 AD D5
1609:C5 03 C9 00 F0 03 4C 6C AA
1611:16 EE CA 03 AD CA 03 C9 F5
1619:70 D0 16 20 F9 16 AD CB C5
1621:03 C9 00 D0 0C AD 0F D0 54
1629:C9 00 F0 08 A9 00 8D 0F 50
1631:D0 4C 98 16 20 F1 15 4C 8C
1639:32 16 A9 50 8D EF 0C 8D 10
1641:E6 0C 4C BC 15 AD 0C D0 81
1649:38 ED 0E D0 C9 00 D0 18 E3
1651:AD 0D D0 38 ED 0F D0 C9 4C
1659:00 D0 0D 20 68 17 A9 7F CF
1661:8D C5 03 A9 00 8D 0F D0 E5
1669:4C E4 0C EE C6 03 AD C6 C9
1671:03 D0 21 EE C7 03 AD C7 D3
1679:03 C9 16 D0 17 A9 00 8D 56
1681:C7 03 EE C8 03 20 7A 19 63
1689:C9 10 D0 08 A9 00 8D C8 6A
1691:03 8D C5 03 4C 04 17 EE 1B
1699:2E D0 EA EA EA A2 0A BD D0
16A1:00 D0 18 7D C8 16 38 ED D9
16A9:0C D0 C9 05 B0 12 BD 01 E3
16B1:D0 18 7D C9 16 38 ED 0D 13
16B9:D0 C9 05 B0 03 4C A6 17 1A
16C1:CA CA 10 DB 4C A2 0D 04 D0
16C9:0B FF 0A FF 0A FF 0A 05 26
16D1:05 03 04 A9 60 8D A1 13 EB
16D9:20 32 18 A9 8D 8D A1 13 39
16E1:4C 78 14 EE CC 13 AD CC 9E
16E9:13 C9 3A D0 08 A9 30 8D 3B
16F1:CC 13 EE C7 13 4C 80 0B 79
16F9:A9 00 8D CA 03 EE CB 03 C7
1701:60 00 00 EE C1 03 AD C1 85
1709:03 C9 04 D0 08 A9 00 8D 2D
1711:C1 03 4C CD 0B 4C 08 16 F6
1719:A2 03 FE 03 07 BD 03 07 A5
1721:C9 3A D0 08 A9 30 9D 03 A9
1729:07 CA 10 EE 4C 4D 17 C0 05
1731:00 D0 0E 84 FC A4 04 20 40
1739:19 17 88 C0 01 D0 F8 A4 B8
1741:FC A5 04 60 00 00 20 30 4E
1749:17 4C 88 13 A2 04 BD 03 FB
1751:07 9D F6 08 CA 10 F7 4C 9C
1759:70 17 A2 04 A9 30 9D 03 66
1761:07 CA 10 FA 4C 82 13 A2 AC
1769:02 20 1B 17 60 00 00 A2 1B
1771:00 38 BD B4 06 FD 03 07 E5
1779:30 09 E9 01 10 13 E8 E0 CE
1781:05 D0 EE A2 04 BD 03 07 92
1789:9D B4 06 9D E6 08 CA 10 4B
1791:F4 60 00 00 AD 36 03 C9 68
1799:06 90 07 C9 15 B0 03 4C 2A
17A1:C1 16 4C D4 16 AD FE 03 75
17A9:D0 EA 4C D4 16 A9 30 8D 17
17B1:BA 17 A2 00 AD 1B D4 9D 78
17B9:00 50 E8 D0 F7 EE BA 17 2E
17C1:AD BA 17 C9 50 D0 EB A9 3C
17C9:30 8D EE 17 A9 00 8D ED 19
17D1:17 4C F2 17 AD ED 17 18 D9
17D9:69 01 8D ED 17 AD EE 17 F1
17E1:69 00 C9 4F D0 02 A9 30 05
17E9:8D EE 17 AD 47 30 60 00 14
17F1:00 A9 E1 8D 14 D4 A9 21 08
17F9:8D 12 D4 A9 0F 8D 18 D4 5C
1801:4C 2A 18 AE 36 03 BD 10 19
1809:18 8D 0F D4 4C E6 0B 00 EB
1811:80 7C 78 74 70 6E 6C 6A 77
1819:68 66 00 00 00 00 00 00 17
1821:00 00 00 00 00 00 00 00 51
1829:00 A9 00 8D 05 D4 4C 4C FC
1831:19 A9 00 8D 0F D4 4C 88 1E
1839:13 EE 0D D0 AD 0D D0 49 E9
1841:FF 8D 0F D4 60 00 00 A9 B0
1849:08 8D 09 D4 8D 0A D4 A9 37
1851:77 8D 06 D4 8D 0D D4 A9 A2
1859:41 8D 0B D4 A9 4C 8D 14 E9
1861:14 A9 00 8D 0F D4 4C 10 53
1869:19 AD FE 2F C9 01 D0 1B 73
1871:AE FF 2F BD 08 19 8D 08 82
1879:D4 A9 28 8D 01 D4 A9 81 8C
1881:8D 04 D4 A9 80 8D 04 D4 C5
1889:4C 05 19 C9 0F D0 28 A9 96
1891:40 8D 0B D4 A9 41 8D 0B 6C
1899:D4 A9 1E 8D 01 D4 EE FF 74
18A1:2F AE FF 2F BD 08 19 8D D5
18A9:08 D4 A9 81 8D 04 D4 A9 30
18B1:80 8D 04 D4 4C 05 19 C9 C5
18B9:10 D0 0F AE FF 2F BD 08 33
18C1:19 18 69 02 8D 08 D4 4C 54
18C9:05 19 C9 18 D0 23 A9 40 24
18D1:8D 0B D4 A9 41 8D 0B D4 EB
18D9:AE FF 2F BD 08 19 18 69 61
18E1:04 8D 08 D4 A9 81 8D 04 38
18E9:D4 A9 80 8D 04 D4 4C 05 E8
18F1:19 C9 1E D0 0F 20 21 19 46
18F9:AD FF 2F C9 08 D0 05 A9 BA
1901:00 8D FF 2F 4C 2C 19 04 D2
1909:08 0C 10 14 10 0C 08 78 BE
1911:A9 32 8D 14 03 A9 19 8D 16
1919:15 03 58 A9 00 4C 43 0C FF
1921:EE FF 2F A9 00 8D FE 2F AE
1929:60 00 00 EE FE 2F 4C 31 F8
1931:EA EE FD 2F AD FD 2F 29 34
1939:01 C9 01 F0 03 4C 31 EA 24
1941:4C 6A 18 20 D5 17 C9 B0 88
1949:B0 F9 60 8D FE 2F 8D FF 07
1951:2F 4C 65 19 AD 8D 02 D0 E4
1959:03 4C A7 15 A9 00 8D 0F DD
1961:D4 4C 55 19 A9 58 8D 18 2F
1969:03 A9 15 8D 19 03 A9 00 2B
1971:8D 10 D0 8D 1B D0 4C 48 5E
1979:18 AD C8 03 C9 0B 90 08 10
1981:AD 2D D0 49 08 8D 2D D0 26
1989:AD C8 03 60 A9 40 8D 15 A9
1991:D0 A9 A9 8D 0C D0 A9 9E 3A
1999:8D 0D D0 A9 26 8D FE 07 F6
19A1:AD 17 07 60 00 00 00 00 57
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The Animals' Show

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HB 70 SCNCLR:COLOR0,1:COLOR4,1
DP 80 GRAPHIC1,1:GRAPHIC0
JC 90 TEMPO57
QC 100 CHAR,2,2,"{6}TO SELECT:
       "
QH 110 CHAR,4,4,"JOYSTICK - PR
       ESS FIRE BUTTON"
KS 120 CHAR,4,6,"KEYPAD --- PR
       ESS 'ENTER' KEY"
BC 130 IFJOY(2)>127THENS$="300
        REM JOYSTICK":GOTO160
BX 140 GETE$:IFE$=CHR$(13)THEN
       S$="300 GOTO340:REM KEY
       PAD":GOTO160
BP 150 GOTO130
DA 160 PRINT"{CLR}{3 DOWN}"S$:
       PRINT"GOTO180{HOME}"
HJ 170 POKE208,2:POKE842,13:PO
       KE843,13:END
GG 180 SCNCLR
JP 190 SE=200:REM MAXIMUM SONG
        LENGTH
ES 200 DIM AN$(6),ZU$(30),V$(8
       ),SG(SE),AP(2,8),ST$(61
       2)
CH 210 GOSUB3560
SB 220 GOSUB3200
GH 230 GOSUB3360
DG 240 CHAR,14,22,"YOU'RE ON I
       N"
GX 250 CHAR,10,23,"15 SECONDS,
        MAESTRO!"
MP 260 GOSUB3480
KE 270 GOSUB490
MH 280 END
KH 290 REM INPUT DEVICE SUBROU
       TINE
JP 300 REM
PB 310 ID=JOY(2):IFID=0GOTO310
EG 320 IFID>128THENID=ID-128
DM 330 RETURN
BC 340 GETKEYNK$
MJ 350 ONVAL(NK$)GOTO390,400,4
       10,420,340,430,440,450,
       460
FE 360 IFNK$="0"THENID=0:GOTO4
       70
ME 370 IFNK$=CHR$(13)THENID=12
       8:GOTO470
RQ 380 GOTO340
KF 390 ID=6:GOTO470
HC 400 ID=5:GOTO470
CC 410 ID=4:GOTO470
BE 420 ID=7:GOTO470
BF 430 ID=3:GOTO470
CG 440 ID=8:GOTO470
HE 450 ID=1:GOTO470
JE 460 ID=2
RE 470 RETURN
MK 480 REM MENU ROUTINE
BA 490 SCNCLR:POKE2604,24
CF 500 GOSUB3140
PP 510 FORI=1TO5:SPRSAVZU$(I*6
       ),I:NEXT
FB 520 MOVSPR1,104,122:MOVSPR2
       ,120,82:MOVSPR3,172,74:
       MOVSPR4,224,82:MOVSPR5,
       240,122
MK 530 CHAR,17,10,"{8}()*)+,"
JR 540 CHAR,11,14,"{7}@@@-
       {DOWN}{4 LEFT}@./@
       {DOWN}{4 LEFT}@01@"
BP 550 CHAR,18,16,"{RED}6778
       {DOWN}{4 LEFT}9:;<
       {DOWN}{4 LEFT}=>>?"
PK 560 CHAR,25,14,"{YEL}WXYZ
       {DOWN}{4 LEFT}2345
       {DOWN}{4 LEFT}+{2 -}_"
DC 570 SPRCOLOR13,2
SE 580 FORI=1TO5:SPRITEI,1,16,
       ,,,1:NEXT
GP 590 CH=1
KH 600 FORID=1TO8
XD 610 GOSUB2980
QK 620 CH=ID
FJ 630 NEXT
DS 640 ID=1
XE 650 GOSUB2980
QQ 660 CH=ID
PK 670 GOSUB300
QQ 680 IFID>8GOTO720
XK 690 GOSUB2980
XS 700 CH=ID
GC 710 GOTO670
EK 720 FORI=1TO5:SPRITEI,0:NEX
       T
CJ 730 SCNCLR
FF 740 GOSUB3140
PP 750 ONCHGOTO1370,1370,1370,
       1100,770,810,1370,1370
PE 760 REM END PROGRAM
MG 770 POKE2604,20
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```
CF 780 COLOR0,12:COLOR4,14:COL
       OR5,14
KK 790 RETURN
DM 800 REM DISK ROUTINE
KJ 810 POKE2604,20
BB 820 CHAR,1,1,"{7}DO YOU WIS
       H TO {CYN}{RVS}S{OFF}
       {7}AVE YOUR SONG
       {11 SPACES}{DOWN}OR
       {CYN}{RVS}L{OFF}{7}OAD
       {SPACE}AN OLD SONG?"
BF 830 GETKEYA$
SK 840 IFA$="S"THENCHAR,1,5,"
       {CYN}SAVE",1:GOTO870
SJ 850 IFA$="L"THENCHAR,1,5,"
       {CYN}LOAD",1:GOTO870
DR 860 GOTO830
GH 870 CHAR,1,7,"{7}WHAT IS TH
       E"
RS 880 CHAR,1,8,"SONG'S NAME"
HE 890 CHAR,14,9,"------------
       ----"
QR 900 CHAR,12,8,"{CYN}"
GJ 910 INPUTN$:N$="S"+N$
KJ 920 IFLEN(N$)>16THENN$=LEFT
       $(N$,16)
SG 930 IFA$="L"GOTO1020
HS 940 DOPEN#1,(N$),D0,U8,W
AF 950 GOSUB5440
BE 960 IFDS=63THENDCLOSE#1,U8:
       CHAR,1,1,"{YEL}THERE IS
        A SONG ON THIS DISK WI
       TH THAT{2 SPACES}{DOWN}
       NAME. PLEASE ENTER A DI
       FFERENT NAME.":GOTO870
XF 970 FORI=1TOSE
RQ 980 PRINT#1,SG(I)
MA 990 NEXT
GS 1000 DCLOSE#1,U8:GOSUB5440
GS 1010 GOTO490
SB 1020 DOPEN#1,(N$),D0,U8
DJ 1030 GOSUB5440
QK 1040 IFDS=62THENDCLOSE#1,U8
       :SCNCLR:CHAR,4,4,"{3}T
       HERE IS NO SONG WITH T
       HAT NAME":CHAR,13,6,"O
       N THIS DISK.":SLEEP6:G
       OTO490
FA 1050 FORI=1TOSE
XE 1060 INPUT#1,SG(I)
SF 1070 NEXT
EP 1080 DCLOSE#1,U8:GOSUB5440:
       SCNCLR
JC 1090 REM PLAY ROUTINE
SC 1100 POKE2604,24
JJ 1110 FORI=1TO5:SPRITEI,1:NE
       XT
EP 1120 CHAR,17,10,"{8}()*)+,"
AR 1130 CH=1:FORID=1TO8
XB 1140 IFID>3ANDID<7GOTO1160
DA 1150 GOSUB2980:CH=ID
HM 1160 NEXT
CP 1170 ID=1:GOSUB2980:CH=ID
QH 1180 GOSUB300:IFID>3ANDID<7
       GOTO1180
RJ 1190 IFID<>128THENGOSUB2980
       :CH=ID:GOTO1180
KE 1200 FORI=1TO5:SPRITEI,0:NE
       XT
SX 1210 SCNCLR
EM 1220 ONCHGOSUB1540,1620,169
       0,,,,1770,1840
BS 1230 GOSUB2010
JE 1240 GOSUB2710
BB 1250 SLEEP1
QC 1260 GOSUB2120
HX 1270 C=0
BX 1280 VOL15
CG 1290 DO WHILE SG(C)<128ANDC
       <SE
AK 1300 C=C+1
PD 1310 ID=SG(C)
AP 1320 GOSUB1910
SC 1330 LOOP
CR 1340 GOSUB2360
SE 1350 GOTO490
MX 1360 REM PERFORMANCE
RB 1370 ONCHGOSUB1540,1620,169
       0,,,,1770,1840
FJ 1380 GOSUB2010
DS 1390 GOSUB2710
CP 1400 GOSUB300:IFID<>128GOTO
       1400
PR 1410 GOSUB2120
MS 1420 GOSUB3140
SK 1430 C=0
GJ 1440 VOL15
MR 1450 DO
BG 1460 GOSUB300
ME 1470 GOSUB1910
DH 1480 C=C+1:IFC>SEGOTO1500
RG 1490 SG(C)=ID
RF 1500 LOOP UNTIL ID=128
GH 1510 GOSUB2360
GB 1520 GOTO490
SX 1530 REM CAT
FK 1540 S=13:SC=9:M1=10:M2=2:R
       S=1590
DH 1550 ENVELOPE 0,5,3,8,3,0
FD 1560 ENVELOPE 1,6,0,5,2,2,4
       000
DQ 1570 ENVELOPE 2,10,3,10,8,2
       ,450
XF 1580 RETURN
XH 1590 DATA "V1 O3 T0 C V2 T1
        C V3 T2 C","V1 O3 T0
       {SPACE}D V2 T1 D V3 T2
        D","V1 O3 T0 E V2 T1
       {SPACE}E V3 T2 E","V1
       {SPACE}O3 T0 F V2 T1 F
        V3 T2 F"
JR 1600 DATA "V1 O3 T0 G V2 T1
        G V3 T2 G","V1 O3 T0
       {SPACE}A V2 T1 A V3 T2
        A","V1 O3 T0 B V2 T1
       {SPACE}B V3 T2 B","V1
       {SPACE}O4 T0 C V2 T1 C
        V3 T2 C"
HQ 1610 REM MOUSE
KR 1620 S=19:SC=10:M1=9:M2=11:
       RS=1660
FR 1630 ENVELOPE 0,5,3,15,1,2,
       200
BS 1640 ENVELOPE 1,7,0,8,0,4
SK 1650 RETURN
GQ 1660 DATA "V1 O5 T0 C V2 T1
        C","V1 O5 T0 D V2 T1
       {SPACE}D","V1 O5 T0 E
       {SPACE}V2 T1 E","V1 O5
        T0 F V2 T1 F"
FE 1670 DATA "V1 O5 T0 G V2 T1
        G","V1 O5 T0 A V2 T1
       {SPACE}A","V1 O5 T0 B
       {SPACE}V2 T1 B","V1 O6
        T0 C V2 T1 C"
CE 1680 REM PARROT
BC 1690 S=25:SC=7:M1=8:M2=11:R
       S=1740
XB 1700 ENVELOPE 0,1,6,7,0,2,1
       600
HX 1710 ENVELOPE 1,3,2,5,2,4
GA 1720 ENVELOPE 2,15,6,15,9,2
       ,1400
CQ 1730 RETURN
GC 1740 DATA "V1 O5 T0 C V2 O1
        T1 C V3 O5 T2 C","V1
       {SPACE}O5 T0 D V2 O1 T
       1 D V3 O5 T2 D","V1 O5
        T0 E V2 O1 T1 E V3 O5
        T2 E","V1  O5 T0 F V2
       {SPACE}O1 T1 F V3 O5 T
       2 F"
QS 1750 DATA "V1 O5 T0 G V2 O1
        T1 G V3 O5 T2 G","V1
       {SPACE}O5 T0 A V2 O1 T
       1 A V3 O5 T2 A","V1 O5
        T0 B V2 O1 T1 B V3 O5
        T2 B","V1 O6 T0 C V2
       {SPACE}O2 T1 C V3 O6 T
       2 C"
AH 1760 REM FROG
BD 1770 S=1:SC=6:M1=14:M2=2:RS
       =1810
JM 1780 ENVELOPE 0,0,0,15,1,1
KB 1790 ENVELOPE 1,5,15,15,8,4
EA 1800 RETURN
BD 1810 DATA "V1 O1 T0 C V2 T1
        C","V1 O1 T0 D V2 T1
       {SPACE}D","V1 O1 T0 E
       {SPACE}V2 T1 E","V1 O1
        T0 F V2 T1 F"
FP 1820 DATA "V1 O1 T0 G V2 T1
        G","V1 O1 T0 A V2 T1
       {SPACE}A","V1 O1 T0 B
       {SPACE}V2 T1 B","V1 O2
        T0 C V2 T1 C"
QF 1830 REM PIG
FJ 1840 S=7:SC=11:M1=3:M2=13:R
       S=1880
QJ 1850 ENVELOPE 0,5,3,8,3,2,3
       75
KA 1860 ENVELOPE 1,10,0,5,0,2,
       3900
XH 1870 RETURN
MQ 1880 DATA "V1 O1 T0 C V2 T1
        C","V1 O1 T0 D V2 T1
       {SPACE}D","V1 O1 T0 E
       {SPACE}V2 T1 E","V1 O1
        T0 F V2 T1 F"
RE 1890 DATA "V1 O1 T0 G V2 T1
        G","V1 O1 T0 A V2 T1
       {SPACE}A","V1 O1 T0 B
       {SPACE}V2 T1 B","V1 O2
        T0 C V2 T1 C"
AF 1900 REM PLAY NOTE & MOVE A
       NIMAL
FG 1910 IFID=128THENRETURN
CG 1920 IFID=0THENFORI=1TO75:N
       EXT:RETURN
EP 1930 SPRSAVAN$(1),ID
SK 1940 PLAYV$(ID)
MK 1950 FORI=2TO6
PG 1960 FORJ=1TO30:NEXT
MC 1970 SPRSAVAN$(I),ID
CS 1980 NEXT
KX 1990 RETURN
EP 2000 REM READ SELECTED ANIM
       AL'S DATA
BQ 2010 C=0
SQ 2020 FORI=STOS+5
RG 2030 C=C+1
JR 2040 AN$(C)=ZU$(I)
RA 2050 NEXT
RD 2060 RESTORE RS
CC 2070 FORI=1TO8
QX 2080 READV$(I)
BE 2090 NEXT
MC 2100 RETURN
EA 2110 REM TURN ON SPRITES &
       {SPACE}OPEN CURTAIN
AG 2120 SPRCOLORM1,M2
FJ 2130 RESTORE2200
BG 2140 FORI=1TO8
BA 2150 READX,Y
XM 2160 SPRSAVAN$(6),I
EC 2170 MOVSPRI,X,Y
CP 2180 SPRITEI,1,SC,1,0,0,1
PM 2190 NEXT
XJ 2200 DATA172,88,212,96,252,
       120,212,144,172,152,13
       2,144,92,120,132,96
KQ 2210 FORI=19TO2STEP-1
HH 2220 FORJ=2TO18
SJ 2230 CHAR,I,J,ST$((I-2)*17+
       J-1)
FK 2240 CHAR,39-I,J,ST$((37-I)
       *17+J-1)
AK 2250 NEXTJ
AH 2260 GOSUB2640
```

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DJ 2270 NEXTI
GM 2280 SOUND1,50000,180,2,350
        00,30,3
SR 2290 SOUND2,50000,180,2,250
        0,7000,3
GE 2300 FORI=5TO0STEP-1
HQ 2310 VOLI
FE 2320 FORJ=1TO250
GP 2330 NEXTJ,I
PC 2340 RETURN
HD 2350 REM CLOSE CURTAIN
MQ 2360 GOSUB2640
PK 2370 X=INT(RND(1)*6+1)*4
QP 2380 IFPEEK(1869+X)=64THENP
        C$="*P{DOWN}{2 LEFT}QR
        ":PO$="{RIGHT}{DOWN}S"
        :GOTO2400
FX 2390 PC$="TG{DOWN}{2 LEFT}U
        I":PO$="{DOWN}V"
CR 2400 COLOR5,15:CHAR,5+X,21,
        PC$
HS 2410 GOSUB2640
DB 2420 FORI=1TO5
PE 2430 CHAR,5+X,21,PO$
XD 2440 GOSUB2640
CX 2450 CHAR,5+X,21,PC$
QJ 2460 FORJ=1TO100
RF 2470 NEXTJ,I
KE 2480 IFPEEK(1869+X)=64THENC
        HAR,5+X,21,"*A{DOWN}
        {2 LEFT}BC":GOTO2500
BJ 2490 CHAR,5+X,21,"FG{DOWN}
        {2 LEFT}HI"
AE 2500 FORI=2TO18
XE 2510 FORJ=2TO17
BQ 2520 CHAR,I,J,"{RED}@J"
KG 2530 CHAR,38-I,J,"K@"
QP 2540 NEXTJ
GR 2550 CHAR,I,J,"FH"
BR 2560 CHAR,38-I,J,"IG"
CP 2570 GOSUB2640
DQ 2580 NEXTI
RJ 2590 FORI=1TO8:SPRITEI,0:NE
        XT
DM 2600 GOSUB2280
HF 2610 SLEEP1
AF 2620 RETURN
KB 2630 REM SOUND OF APPLAUSE
ES 2640 FILTER2000,1,0,0,0
JJ 2650 VOL5
BK 2660 SOUND1,50000,60,2,3500
        0,30,3
JX 2670 SOUND2,50000,60,2,2500
        ,7000,3
JC 2680 IFRND(1)>.85THENSOUND3
        ,55000,55,2,35000,2000
        ,2,2000
XP 2690 RETURN
DK 2700 REM DRAW STAGE & AUDIE
        NCE
GE 2710 FAST
GQ 2720 PRINT"{CLR}{RED}@@@@@@
        @@@@@@@@@@@@@@@@@@@@@@
        @@@@@@@@@@@@FFFFFFFFFF
        FFFFFFFFFFFFFFFFFFFFFF
        FFFFFFFF";
EB 2730 FORI=1TO16
KH 2740 PRINT"@@@@@@@@@@@@@@@@
        @@@JK@@@@@@@@@@@@@@@@
        @@";
RX 2750 NEXT
XJ 2760 PRINT"FFFFFFFFFFFFFFFF
        FFFHIGGGGGGGGGGGGGGGG
        GG"
XC 2770 PRINT"{8}CBA@Z[@@@Z[@@
        @Z[@@@Z[@@@Z[@@@Z[@@@Z
        [@ABC"
PX 2780 FORI=1TO8
CR 2790 IFRND(1)>.5THENP$="{7}
        .*A{DOWN}{2 LEFT}BC":GO
        TO2810
SQ 2800 P$="{7}FG{DOWN}
        {2 LEFT}HI"
BX 2810 CHAR,1+I*4,21,P$
RD 2820 NEXT
RF 2830 CHAR,3,22,"*A{DOWN}
        {2 LEFT}BEEE"
QR 2840 FORI=1TO7
XB 2850 IFRND(1)>.5THENP$="*A
        {DOWN}{2 LEFT}DEEE":GO
        TO2870
MA 2860 P$="FG{DOWN}{2 LEFT}JK
        EE"
RA 2870 CHAR,3+I*4,22,P$
DG 2880 NEXT
RC 2890 CHAR,35,22,"FG{DOWN}
        {2 LEFT}JI"
DR 2900 CHAR,2,24,"LEEO"
SB 2910 FORI=1TO7
HR 2920 CHAR,2+I*4,24,"NEEO"
SJ 2930 NEXT
CG 2940 CHAR,34,24,"NEEM"
EQ 2950 SLOW
PM 2960 RETURN
RF 2970 REM  POSITION ARROW
PG 2980 FORJ=0TO1
DE 2990 IFJ=0THENTP=CH:COLOR5,
        12
JR 3000 IFJ=1THENTP=ID:COLOR5,
        16
QM 3010 ONTPGOTO3030,3040,3050
        ,3060,3070,3080,3090,3
        100
PR 3020 GOTO3110
AP 3030 CHAR,19,7,"£]":GOTO31
        10
JB 3040 CHAR,22,8,"↑":GOTO3110
CM 3050 CHAR,24,10,"←":GOTO311
        0
FS 3060 CHAR,22,12,"↓":GOTO311
        0
KH 3070 CHAR,19,13,"#$":GOTO31
        10
RB 3080 CHAR,17,12,"%":GOTO311
        0
BH 3090 CHAR,15,10,"&":GOTO311
        0
DA 3100 CHAR,17,8,"'"
QQ 3110 NEXTJ
KC 3120 RETURN
MC 3130 REM CLEAR KEYBOARD BUF
        FER
MH 3140 FORI=842TO851
GC 3150 POKEI,0
RG 3160 NEXT
FM 3170 POKE208,0
XK 3180 RETURN
XS 3190 REM TITLE SCREEN
KM 3200 SCNCLR
FR 3210 RESTORE3310
GX 3220 COLOR5,11
BS 3230 FORY=1TO19
MB 3240 READX,A$
JR 3250 CHAR,X,Y,A$
HX 3260 NEXT
SG 3270 COLOR5,15
GD 3280 REM
PD 3290 REM
PX 3300 RETURN
FX 3310 DATA12,"{RVS}
        {9 SPACES}",12,"{RVS}
        {9 SPACES}",14,"{RVS}
        {5 SPACES}",14,"{RVS}
        {5 SPACES}{G} {RIGHT}
        {2 SPACES}{G} {2 @}"
AP 3320 DATA14,"{RVS}
        {5 SPACES}{G}
        {4 SPACES}{G}
        {2 SPACES}",14,"{RVS}
        {5 SPACES}{G} {RIGHT}
        {2 SPACES}{G} {2 T}",6
        ,"{RVS}£{*}",5,"{RVS}
        £{2 SPACES}{*}",4,"
        {RVS}£{4 SPACES}{*}",
        3,"{RVS}£{2 SPACES}
        {2 I}{2 SPACES}{*}
        {2 SPACES}{*}
        {2 SPACES}{G}
        {2 SPACES}{M}
        {2 SPACES}{*}£
        {2 SPACES}{RIGHT}£{*}
        {RIGHT}{2 SPACES}
        {2 RIGHT}£{2 SPACES}
        {*}{OFF}£{UP}{2 LEFT}
        {RVS}{G}"
FH 3330 DATA2,"{RVS}£
        {3 SPACES}{OFF}{2 I}
        {RVS}{3 SPACES}M
        {4 SPACES}{RIGHT}
        {2 SPACES}{RIGHT}
        {6 SPACES}£{D}{F}{*}
        {2 SPACES}{2 RIGHT}
        {OFF}{*}{RVS}{@}{T}{*}
        ",1,"{RVS}£{4 SPACES}
        {2 I}{4 SPACES}M{OFF}
        {*}{RVS}{2 SPACES}{G}
        {2 SPACES}{M}
        {2 SPACES}{OFF}{*}£
        {RVS}{2 SPACES}{G}{D}
        {F} M{2 SPACES}{M}
        {OFF}{*}{RVS}
        {2 SPACES}{OFF}£",0,"
        "
AS 3340 DATA9,"{RVS}£
        {5 SPACES}{*}",8,"
        {RVS}£{7 SPACES}{*}",
        8,"{OFF}{*}{RVS}
        {4 SPACES}{2 T}{*}",9,
        "{OFF}{*}{RVS}{2 @}
        {4 SPACES}M {RIGHT}
        {M}£{3 SPACES}{*}{G}
        {SPACE}£{*} {M}",8,"
        {OFF}{*}{RVS}
        {7 SPACES}N{3 SPACES}
        {M}{2 SPACES}{RIGHT}
        {2 SPACES}{G}
        {4 SPACES}{M}",9,"
        {OFF}{*}{RVS}
        {5 SPACES}{OFF}£{RVS}
        {G} {RIGHT} {M}{OFF}
        {*}{RVS}{3 SPACES}
        {OFF}£{RVS}{G} {OFF}
        £{*}{RVS} {M}{OFF}"
SM 3350 REM READ SPRITE DATA
JR 3360 RESTORE 3820
SQ 3370 FORI=0TO24STEP6
GJ 3380 FORJ=3584TO3967
RB 3390 READK
DE 3400 POKEJ,K
QB 3410 NEXTJ
FB 3420 FORJ=1TO6
HP 3430 SPRSAVJ,ZU$(I+J)
HD 3440 NEXTJ
PC 3450 NEXTI
GJ 3460 RETURN
RF 3470 REM READ CHARACTER DAT
        A
FP 3480 RESTORE4480
CE 3490 FORI=0TO93
MF 3500 FORJ=0TO7
BH 3510 READK
CM 3520 POKE8192+(I*8)+J,K
QK 3530 NEXTJ
AK 3540 NEXTI
KS 3550 RETURN
HM 3560 FAST
RA 3570 FORI=1TOSE:SG(I)=INT(R
        ND(1)*9):NEXT
FK 3580 RESTORE 3620
FX 3590 FORI=1TO2:FORJ=1TO8
AH 3600 READAP(I,J)
CP 3610 NEXTJ,I
BH 3620 DATA19,7,22,8,24,10,22
        ,12,19,13,17,12,15,10,
        17,8
XX 3630 RESTORE3700
BJ 3640 FORI=1TO612
HR 3650 READST$(I)
BB 3660 NEXTI
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MP 3670 SLOW
XK 3680 RETURN
AB 3690 REM STAGE DATA
XQ 3700 DATA "{RED}J",J,J,J,J,
        J,J,J,J,J,J,J,J,J,J,J,
        H,"{BLU}J",J,J,J,J,J,J
        ,J,J,J,H,"§8§@",@,@,@,
        @,@,"§7§@",@,@,@,@,@,@
        ,F,"§8§@",@,@,@,@,@,@,
        @,@
FE 3710 DATA "§7§J",J,J,J,J,J,
        J,H,"§8§@",@,@,@,@,@,@
        ,@,@,"{CYN}@",@,@,@,@,
        D,"§8§@",@,@,@,@,@,@,@
        ,@,@,@,"{CYN}@",@,@,@,
        @,D,"§8§@",@,@,@,@,@,@
        ,@,@,@,@
XH 3720 DATA "{CYN}@",@,@,@,@,
        D,"§8§L",P,R,T,V,X,@,@
        ,@,@,@,"{CYN}@",@,@,@,
        @,D,"§8§M"," "," "," "
        ,@,@,@,@,@,@,@,@,"{CYN}@
        ",@,@,@,@,@,D,"§8§N"," "
        ," "," ",@,@,@,@,@,@,@
MJ 3730 DATA "{CYN}@",@,@,@,@,
        D,"§8§O",Q,S,U,W,Y,@,@
        ,@,@,@,"{CYN}@",@,@,@,
        @,D,"§8§@",@,@,@,@,@,@
        ,@,@,@,@,@,"{CYN}@",@,@,
        L,P,R,"§8§T",V,X,L,P,R
        ,T,V,X,@,@
DR 3740 DATA "{CYN}@",@,@,M,"
        {SPACE}"," ","§8§ ",@,
        @,M," "," "," ",@,@,@,
        @,"{CYN}@",@,@,N," ","
         ","§8§ ",@,@,N," ","
        {SPACE}"," ",@,@,@,@,"
        {CYN}@",@,@,O,Q,S,U,W,
        Y,O,Q,S,U,W,Y,@,@
CK 3750 DATA "{CYN}@",@,@,@,@,
        D,"§8§@",@,@,@,@,@,@,@
        ,@,@,@,"{CYN}@",@,L,P,
        R,T,"§8§V",X,@,@,L,P,R
        ,T,V,X,@,"{CYN}@",@,M,
        " "," "," "," ","§8§@",@,
        @,M," "," "," ",@,@,@
FX 3760 DATA "{CYN}@",@,N," ",
        " "," "," "§8§@",@,@,@,N
        , " "," "," ",@,@,@,"
        {CYN}@",@,O,Q,S,U,"§8§
        W",Y,@,@,O,Q,S,U,W,Y,@
        ,"{CYN}@",@,@,@,@,@,D,"
        §8§@",@,@,@,@,@,@,@,@,
        @,@
GG 3770 DATA "{CYN}@",@,@,L,P,
        R,"§8§T",V,X,L,P,R,T,V
        ,X,@,@,"{CYN}@",@,@,M,
        " "," "," "§8§ ",@,@,M,"
          ,"," "," ",@,@,@,@,"
        {CYN}@",@,@,N," "," ","
        §8§ ",@,@,N," "," ","
          ",@,@,@,@
PB 3780 DATA "{CYN}@",@,@,O,Q,
        S,"§8§U",W,Y,O,Q,S,U,W
        ,Y,@,@,"{CYN}@",@,@,@,
        @,D,"§8§@",@,@,@,@,@,@,@
        ,@,@,@,@,"{CYN}@",@,@,
        @,@,D,"§8§L",P,R,T,V,X
        ,@,@,@,@,@,@
XD 3790 DATA "{CYN}@",@,@,@,@,
        D,"§8§M"," "," "," "," ",@
        ,@,@,@,@,@,@,@,"{CYN}@",
        @,@,@,@,@,D,"§8§N"," ","
          "," ",@,@,@,@,@,@,@,@,"
        {CYN}@",@,@,@,@,@,D,"§8§
        O",Q,S,U,W,Y,@,@,@,@,@,@
QF 3800 DATA "{CYN}@",@,@,@,@,
        D,"§8§@",@,@,@,@,@,@,@
        ,@,@,@,"{CYN}@",@,@,@,
        @,D,"§8§@",@,@,@,@,@,@,@
        ,@,@,@,@,"§7§K",K,K,K,
        K,K,K,I,"§8§@",@,@,@,@,
        ,@,@,@,@
AP 3810 DATA "§7§@",@,@,@,@,@,
        @,G,"§8§@",@,@,@,@,@,@
        ,@,@,"{BLU}K",K,K,K,K,
        K,K,K,K,K,I,"§8§@",@,@
        ,@,@,@,"{RED}K",K,K,K,
        K,K,K,K,K,K,K,K,K,K,K,
        K,I
BG 3820 REM FROG DATA
KS 3830 DATA 0,0,0,0,0,0,0,0,0,0
        ,2,130,128,11,235,224,
        11,40,224,42,170,168,1
        70,170,170,128,0,2,170
        ,170,170,42,170
GA 3840 DATA 168,10,170,160,26
        ,170,168,106,170,170,1
        70,170,170,166,170,170
        ,166,169,170, 41,166,1
        68,10,166,160,40,166,4
        0,162,130,138,0
SJ 3850 DATA 0,0,0,0,0,0,0,2,130
        ,128,11,235,224,11,40,
        224,43,235,232,170,170
        ,170,128,0,2,170,170,1
        70,42,170,168,10,170
HQ 3860 DATA 160,10,170,160,26
        ,170,168,106,170,170,1
        70,170,170,166,170,170
        ,166,169,170,41,166,16
        8,10,166,160,40,166,40
        ,162,130,138,0
BQ 3870 DATA 0,0,0,0,0,0,0,2,130
        ,128,11,40,224,11,235,
        224,43,235,232,170,170
        ,170,128,0,2,160,0,10,
        42,0,168,10,170
ED 3880 DATA 160,10,170,160,26
        ,170,168,106,170,170,1
        70,170,170,166,170,170
        ,166,169,170,41,166,16
        8,10,166,160,168,130,4
        2,0,130,0,0
AC 3890 DATA 0,0,0,0,0,0,0,2,130
        ,128,11,40,224,11,235,
        224,43,235,232,170,170
        ,170,160,0,10,160,0,10
        ,40,0,40,42,0
DS 3900 DATA 168,10,170,160,26
        ,170,168,106,170,170,1
        70,170,170,166,170,170
        ,166,169,170,41,166,16
        8,10,166,160,168,130,4
        2,0,130,0,0
JS 3910 DATA 0,0,0,0,0,0,0,0,0,0
        ,2,130,128,10,170,160,
        11,40,224,42,170,168,1
        70,170,170,128,0,2,168
        ,0,42,42,170
HR 3920 DATA 168,10,170,160,26
        ,170,168,106,170,170,1
        70,170,170,166,170,170
        ,166,169,170,41,166,16
        8,10,166,160,40,130,40
        ,130,0,130,0
DB 3930 DATA 0,0,0,0,0,0,0,0,0,0
        ,2,130,128,10,170,160,
        11,40,224,42,170,168,1
        70,170,170,128,0,2,170
        ,170,170,42,170
QP 3940 DATA 168,10,170,160,26
        ,170,168,106,170,170,1
        70,170,170,166,170,170
        ,166,169,170,41,166,16
        8,10,166,160,40,166,40
        ,162,130,138,0
ME 3950 REM PIG DATA
AD 3960 DATA 0,0,0,0,2,0,2,9,0
        ,9,164,0,2,170,0,6,168
        ,160,10,138,144,10,170
        ,96,6,170,160,1,170,12
        8,2,170
JP 3970 DATA 0,6,170,64,10,106
        ,144,10,154,160,1,154,
        168,137,186,168,42,250
        ,168,138,170,164,42,16
        6,160,2,154,144,0,188,
        92,0
CP 3980 DATA 0,0,0,0,2,0,2,9,0
        ,9,164,0,2,170,0,6,168
        ,160,10,138,144,10,170
        ,96,6,170,160,1,170,0,
        2,170
JH 3990 DATA 128,6,170,64,10,1
        06,144,10,154,160,1,15
        4,168,137,186,168,42,2
        50,168,138,170,164,42,
        166,160,2,154,144,0,18
        8,92,0
GJ 4000 DATA 0,0,0,0,0,0,42,10
        ,128,6,169,0,2,170,0,1
        0,136,128,10,170,160,1
        0,169,144,6,170,160,1,
        160,0,2,168
BP 4010 DATA 128,6,170,128,10,
        106,144,6,106,160,134,
        154,168,33,186,168,138
        ,250,168,138,170,164,4
        2,166,160,2,154,144,0,
        188,92,0
EF 4020 DATA 0,0,0,32,0,0,10,2
        ,128,6,169,32,2,170,0,
        10,136,128,10,170,160,
        10,169,144,6,138,160,1
        ,128,0,2,160
KD 4030 DATA 128,6,170,128,10,
        106,144,6,106,160,134,
        106,168,33,186,168,138
        ,250,168,138,170,164,4
        2,166,160,2,154,144,0,
        188,92,0
JC 4040 DATA 0,0,0,0,0,0,42,2,
        128,6,169,128,2,170,0,
        10,136,128,10,170,160,
        10,169,144,6,138,160,1
        ,160,0,2,168
KX 4050 DATA 128,6,170,128,10,
        106,144,6,106,160,1,15
        4,168,137,186,168,42,2
        50,168,138,170,164,42,
        166,160,2,154,144,0,18
        8,92,0
QM 4060 DATA 0,0,0,0,2,0,2,9,0
        ,9,164,0,2,170,0,6,168
        ,160,10,138,144,10,170
        ,96,6,162,160,1,168,0,
        2,170
HD 4070 DATA 128,6,170,64,10,1
        06,144,10,154,160,1,15
        4,168,137,186,168,42,2
        50,168,138,170,164,42,
        166,160,2,154,144,0,18
        8,92,0
SK 4080 REM CAT DATA
QF 4090 DATA 0,0,0,8,8,0,10,40
        ,0,10,168,0,11,184,0,8
        ,136,0,10,168,0,56,11,
        0,14,44,0,58,171,0,6,3
        6
FQ 4100 DATA 0,2,160,0,1,144,2
        ,2,168,9,10,170,8,10,1
        66,136,2,154,134,1,154
        ,129,1,154,161,1,134,1
        53,6,42,4,0
QH 4110 DATA 0,0,0,8,8,0,10,40
        ,0,10,168,0,8,136,0,11
        ,184,0,10,168,0,56,11,
        0,14,44,0,58,171,0,6,3
        6
EH 4120 DATA 0,2,32,32,1,144,3
        2,2,168,32,10,170,24,1
        0,166,132,2,154,134,1,
        154,129,1,154,161,1,13
        4,153,6,42,4,0
SJ 4130 DATA 0,0,0,8,8,0,10,40
        ,0,10,168,0,8,136,0,11
        ,184,0,10,168,0,200,8,
        192,62,47,0,202,168,19
        2,10,40
```

```
CP 4140 DATA 0,6,36,0,2,32,0,2
        ,168,0,10,170,0,10,166
        ,168,2,154,134,1,154,1
        29,1,154,161,1,134,153
        ,6,42,4,0
AK 4150 DATA 0,0,0,8,8,0,10,40
        ,0,10,168,0,8,136,0,11
        ,184,0,10,168,0,200,8,
        192,62,47,0,202,168,19
        2,10,40
SS 4160 DATA 0,6,36,0,2,32,0,2
        ,168,0,10,170,0,10,166
        ,128,2,154,152,1,154,1
        49,1,154,161,1,134,153
        ,6,42,4,0
AK 4170 DATA 0,0,0,8,8,0,10,40
        ,0,10,168,0,11,184,0,8
        ,136,0,10,168,0,56,11,
        0,14,44,0,58,171,0,6,3
        6
EG 4180 DATA 0,2,32,0,1,144,12
        8,2,168,104,10,170,6,1
        0,166,129,2,154,129,1,
        154,137,1,154,164,1,13
        4,144,6,42,0,0
FB 4190 DATA 0,0,0,8,8,0,10,40
        ,0,10,168,0,11,184,0,8
        ,136,0,10,168,0,56,11,
        0,14,44,0,58,171,0,6,1
        00
MX 4200 DATA 2,2,160,9,1,144,8
        ,2,168,8,10,170,6,10,1
        66,129,2,154,130,1,154
        ,137,1,154,164,1,134,1
        44,6,42,0,0
MQ 4210 REM MOUSE DATA
KF 4220 DATA 0,0,0,0,0,0,0,0,0
        ,0,0,0,0,0,0,0,0,0,0,0
        ,0,0,130,0,0,171,0,1,1
        38,0,3,250
PB 4230 DATA 0,3,250,128,0,58,
        128,0,234,160,0,171,16
        0,3,174,160,0,170,144,
        3,171,140,3,3,12,0,0,4
        8,0,15,192,0
SF 4240 DATA 0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0,0,0,0,0,0,0,1
        30,0,0,171,0,1,138,0,3
        ,250,0,3,250
DD 4250 DATA 0,0,58,128,0,58,1
        28,0,250,160,0,171,160
        ,3,174,160,0,170,144,3
        ,171,140,3,3,0,0,12,
        0,3,240,0
PJ 4260 DATA 0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0,130,0,0,171,0
        ,1,138,0,3,250,0,3,250
        ,0,0,58,0,0,58
RS 4270 DATA 0,0,58,128,0,250,
        128,0,170,160,13,170,1
        76,2,170,160,0,170,144
        ,3,170,204,3,0,195,0,0
        ,3,0,0,252,0
QP 4280 DATA 0,0,0,0,0,0,0,130
        ,0,0,131,0,0,171,0,1,1
        38,0,3,250,0,3,254,0,0
        ,46,0,0,14,0,0,14
QE 4290 DATA 0,0,46,0,0,250,12
        8,0,170,172,13,170,160
        ,2,170,160,0,170,144,3
        ,170,204,3,0,195,0,0,1
        2,0,3,240,0
KR 4300 DATA 0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0,0,0,0,130,0,0
        ,171,0,1,138,0,3,250,0
        ,3,250,0,0,58
DX 4310 DATA 0,0,58,128,0,250,
        128,0,170,160,3,170,17
        6,0,170,224,0,170,144,
        3,171,140,3,3,3,0,0,12
        ,0,3,240,0
XD 4320 DATA 0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0,0,0,0,0,0,0,0
        ,0,0,130,0,0,171,0,1,1
        38,0,3,250
QB 4330 DATA 0,3,250,128,0,234
        ,128,0,171,160,3,174,1
        60,0,170,160,0,170,144
        ,3,175,140,3,12,12,0,0
        ,48,0,15,192,0
QS 4340 REM PARROT DATA
MJ 4350 DATA 0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0,40,0,15,150,0
        ,63,134,128,255,134,12
        8,207,150,128,3,170,0,
        0,40
QP 4360 DATA 0,0,8,0,0,40,0,1,
        169,0,6,165,64,6,165,6
        4,2,169,64,1,170,64,0,
        42,128,3,207,160,3,12,
        40,0
PB 4370 DATA 0,0,0,0,0,0,0,0,0,0
        ,60,40,0,255,134,0,255
        ,134,128,195,150,128,1
        5,150,128,3,170,0,0,40
        ,0,0,8
FK 4380 DATA 0,0,40,0,1,170,64
        ,6,169,64,6,169,64,2,1
        69,64,1,170,64,0,42,12
        8,0,251,160,3,207,160,
        3,12,40,0
MM 4390 DATA 0,0,0,0,0,0,63,40
        ,0,255,134,0,195,134,1
        28,3,150,128,3,150,128
        ,15,170,0,0,40,0,0,8,0
        ,0,40
FR 4400 DATA 0,5,170,64,6,170,
        80,6,170,80,6,170,64,1
        ,170,64,0,42,128,0,59,
        160,0,243,160,3,207,40
        ,3,12,0,0
GC 4410 DATA 60,0,0,255,40,0,2
        07,134,0,3,134,128,3,1
        34,128,3,150,128,15,17
        0,0,0,42,0,0,8,0,0,8,0
        ,4,40
EM 4420 DATA 16,21,170,84,22,1
        70,148,22,170,148,6,17
        0,144,4,170,16,0,42,12
        8,0,59,160,0,243,160,3
        ,207,40,3,12,0,0
MF 4430 DATA 0,0,0,0,0,0,0,0,0,0
        ,0,40,0,15,150,0,63,13
        4,128,255,134,128,195,
        150,128,15,170,0,0,40,
        0,0,8
MG 4440 DATA 0,0,8,0,4,40,64,2
        1,169,80,22,169,80,22,
        169,80,22,170,80,4,170
        ,16,0,42,128,3,207,160
        ,3,12,40,0
BB 4450 DATA 0,0,0,0,0,0,0,0,0,0
        ,0,0,0,0,40,0,15,150,0
        ,63,134,128,255,134,12
        8,207,150,128,3,170,0,
        0,40
PQ 4460 DATA 0,0,8,0,4,40,64,2
        1,169,80,22,169,80,22,
        169,80,6,170,80,1,170,
        64,0,42,128,3,207,160,
        3,12,40,0
MF 4470 REM CHARACTER DATA
GA 4480 DATA 255,255,255,255,2
        55,255,255,255
EP 4490 DATA 255,255,255,255,2
        55,255,0,0
RX 4500 DATA 255,255,255,255,0
        ,0,0,0
CJ 4510 DATA 255,255,0,0,0,0,0
        ,0
RE 4520 DATA 255,255,255,255,2
        55,255,85,170
DH 4530 DATA 255,0,170,85,170,
        85,170,85
CQ 4540 DATA 255,255,231,102,1
        02,24,24,0
RR 4550 DATA 255,255,231,102,1
        02,24,24,0
RP 4560 DATA 254,254,230,102,1
        02,24,24,0
SM 4570 DATA 127,127,103,102,1
        02,24,24,0
ES 4580 DATA 254,254,254,254,2
        54,254,254,254
SB 4590 DATA 127,127,127,127,1
        27,127,127,127
JH 4600 DATA 255,252,240,224,1
        92,192,128,128
GE 4610 DATA 255,31,4,0,0,0,0,
        0
XM 4620 DATA 255,248,32,0,0,0,
        0,0
FK 4630 DATA 255,63,15,7,3,3,1
        ,1
SA 4640 DATA 128,128,128,128,1
        28,128,128,128
AF 4650 DATA 1,1,1,1,1,1,1,1
JB 4660 DATA 128,192,192,192,1
        92,224,224,224
CF 4670 DATA 1,3,3,3,3,7,7,7
DC 4680 DATA 192,128,0,32,24,1
        66,144,157
KD 4690 DATA 3,1,0,4,24,101,9,
        185
KC 4700 DATA 156,156,156,156,1
        56,156,156,156
GF 4710 DATA 57,57,57,57,57,57
        ,57,57
AR 4720 DATA 157,159,159,159,1
        59,191,255,255
QR 4730 DATA 185,249,249,249,2
        49,253,255,255
FK 4740 DATA 255,248,224,192,1
        92,192,128,128
FK 4750 DATA 255,31,7,3,3,3,1,
        1
SR 4760 DATA 1,3,7,13,1,1,1,1
BK 4770 DATA 128,192,224,176,1
        28,128,128,128
GJ 4780 DATA 63,31,15,31,59,11
        2,224,64
PG 4790 DATA 8,12,6,255,255,6,
        12,8
FG 4800 DATA 0,0,0,0,0,0,0,0
HE 4810 DATA 64,224,112,59,31,
        15,31,63
PH 4820 DATA 0,0,0,0,0,0,0,0
HF 4830 DATA 1,1,1,1,13,7,3,1
MR 4840 DATA 128,128,128,128,1
        76,224,192,128
CP 4850 DATA 2,7,14,220,248,24
        0,248,252
XG 4860 DATA 16,48,96,255,255,
        96,48,16
DS 4870 DATA 252,248,240,248,2
        20,14,7,2
QQ 4880 DATA 0,126,96,126,6,6,
        126,0
FQ 4890 DATA 0,126,96,120,96,9
        6,126,0
BQ 4900 DATA 0,96,96,96,96,96,
        126,0
HX 4910 DATA 0,126,96,96,96,96
        ,126,0
QQ 4920 DATA 0,126,24,24,24,24
        ,24,0
XF 4930 DATA 255,255,255,255,2
        55,240,240,240
GX 4940 DATA 252,243,228,232,2
        32,228,243,252
PX 4950 DATA 63,207,39,23,23,3
        9,207,63
RK 4960 DATA 255,254,252,252,2
        52,252,254,255
HB 4970 DATA 255,127,63,63,63,
        63,127,255
AD 4980 DATA 192,192,207,205,2
        07,204,204,224
XF 4990 DATA 219,0,48,176,48,4
        8,62,0
```

```
FQ 5000 DATA 224,0,51,121,204,
        252,204,0
RB 5010 DATA 3,3,51,227,195,19
        5,195,7
KS 5020 DATA 1,3,6,13,27,55,11
        1,223
AM 5030 DATA 255,0,255,255,255
        ,255,255,255
GA 5040 DATA 128,192,96,176,21
        6,236,246,251
JF 5050 DATA 184,176,179,176,1
        84,190,176,176
HR 5060 DATA 64,64,243,243,115
        ,115,115,243
PF 5070 DATA 206,134,134,50,50
        ,134,134,206
KJ 5080 DATA 29,13,77,77,13,29
        ,125,125
SB 5090 DATA 223,111,55,27,13,
        6,3,1
AE 5100 DATA 255,255,255,255,2
        55,255,0,255
RC 5110 DATA 251,246,236,216,1
        76,96,192,128
GK 5120 DATA 7,15,31,31,63,63,
        63,63
FQ 5130 DATA 224,240,248,248,2
        52,252,252,252
CE 5140 DATA 63,31,31,15,15,15
        ,31,127
BD 5150 DATA 252,248,248,240,2
        40,240,248,254
KM 5160 DATA 63,31,159,79,175,
        79,31,127
GA 5170 DATA 252,249,250,241,2
        42,241,248,254
SG 5180 DATA 0,0,7,15,31,31,63
        ,63
GX 5190 DATA 0,0,224,240,248,2
        48,252,252
DX 5200 DATA 63,63,63,63,255,1
        27,15,63
GK 5210 DATA 252,252,252,252,2
        55,254,240,252
AM 5220 DATA 63,63,191,63,255,
        127,15,63
KQ 5230 DATA 252,253,252,252,2
        55,254,240,252
HC 5240 DATA 0,0,10,21,42,85,4
        2,85
SS 5250 DATA 0,0,168,84,170,84
        ,170,84
BG 5260 DATA 170,64,138,21,42,
        85,42,85
RG 5270 DATA 170,1,168,84,170,
        84,170,84
XA 5280 DATA 224,248,252,248,2
        00,248,236,254
FH 5290 DATA 63,63,31,31,15,7,
        31,127
KF 5300 DATA 248,248,248,248,1
        92,224,248,254
DG 5310 DATA 248,248,224,248,2
        48,224,248,254
CF 5320 DATA 0,0,3,15,31,63,63
        ,31
CE 5330 DATA 19,51,63,31,31,31
        ,7,63
XP 5340 DATA 19,51,63,31,7,31,
        7,63
XS 5350 DATA 3,31,62,112,96,96
        ,224,192
RG 5360 DATA 255,255,0,0,243,2
        19,243,219
RJ 5370 DATA 255,255,0,0,224,0
        ,207,0
AP 5380 DATA 192,248,124,14,6,
        6,7,3
KQ 5390 DATA 96,96,112,62,31,3
        ,0,0
XA 5400 DATA 0,0,0,0,255,255,0
        ,0
FM 5410 DATA 6,0,48,60,255,255
        ,60,48
MH 5420 REM READ ERROR CHANNEL
KC 5430 END
EB 5440 IFDS=62ORDS=63THENPRIN
        T"{BLK}"DS$:RETURN
KD 5450 IFDS=0THENRETURN
DJ 5460 PRINTDS$:STOP
```

128 Quicksort

See instructions in article on page 86 before typing in.

Program 1: Quicksort 128

```
1300:4C 23 13 00 00 00 00 00 77
1308:00 00 00 00 00 00 00 00 2E
1310:00 00 00 00 00 00 00 00 36
1318:00 00 00 00 00 00 00 00 3E
1320:00 00 00 20 5C 79 20 D7 29
1328:77 20 15 88 A5 16 8D 18 F5
1330:13 A5 17 8D 19 13 20 5C B6
1338:79 20 EF 77 A5 49 8D 03 09
1340:13 A5 4A 8D 04 13 20 0B 33
1348:17 20 A8 17 A5 FA F0 01 84
1350:60 A2 01 8E 10 13 8E 0C 4E
1358:13 CA 8E 11 13 8E 0D 13 9D
1360:20 F8 15 AD 18 13 8D 1E 98
1368:13 AD 19 13 8D 1F 13 20 07
1370:14 16 20 C3 15 20 D9 15 58
1378:38 AD 10 13 E9 01 8D 10 D7
1380:13 AD 11 13 E9 00 8D 11 6A
1388:13 AD 20 13 8D 0C 13 AD 49
1390:21 13 8D 0D 13 AD 1E 13 2D
1398:8D 0A 13 AD 1F 13 8D 0B B0
13A0:13 18 AD 20 13 6D 1E 13 AB
13A8:85 FA AD 21 13 6D 1F 13 B7
13B0:4A 85 FB 66 FA 20 76 17 9F
13B8:AD 0C 13 85 FA AD 0D 13 2F
13C0:85 FB 20 AD 16 AD 22 13 46
13C8:C9 02 D0 06 20 88 14 4C 66
13D0:B8 13 AD 0A 13 85 FA AD C0
13D8:0B 13 85 FB 20 AD 16 AD 4B
13E0:22 13 C9 01 D0 06 20 9A 9F
13E8:14 4C D2 13 AD 0C 13 8D 09
13F0:12 13 AD 0D 13 8D 13 13 73
13F8:AD 0A 13 8D 14 13 AD 0B 07
1400:13 8D 15 13 20 89 16 AD E9
1408:22 13 C9 01 F0 0C 20 04 4B
1410:15 20 88 14 20 9A 14 4C FC
1418:B8 13 AD 1E 13 8D 14 13 03
1420:AD 1F 13 8D 15 13 20 89 E0
1428:16 AD 22 13 C9 02 D0 17 4B
1430:18 AD 10 13 69 01 8D 10 7D
1438:13 AD 11 13 69 00 8D 11 20
1440:13 20 F8 15 20 14 16 AD 95
1448:0A 13 8D 1E 13 AD 0B 13 46
1450:8D 1F 13 AD 20 13 8D 12 BE
1458:13 AD 21 13 8D 13 13 AD 57
1460:1E 13 8D 14 13 AD 1F 13 EF
1468:8D 15 13 20 89 16 AD 22 23
1470:13 C9 02 D0 03 4C 89 13 51
1478:AD 10 13 D0 05 AD 11 13 FE
1480:F0 03 4C 72 13 85 FA 60 97
1488:18 AD 0C 13 69 01 8D 0C 51
1490:13 AD 0D 13 69 00 8D 0D F3
1498:13 60 38 AD 0A 13 E9 01 B5
14A0:8D 0A 13 AD 0B 13 E9 00 C7
14A8:8D 0B 13 60 20 D0 14 A9 D8
14B0:47 A2 01 A0 00 20 74 FF B8
14B8:8D 09 13 A9 47 A2 01 C8 76
14C0:20 74 FF 85 FE A9 47 A2 3E
14C8:01 C8 20 74 FF 85 FF 60 65
14D0:A5 FA 0A 85 47 A5 FB 2A 17
14D8:85 48 18 A5 47 65 FA 85 7E
14E0:47 A5 48 65 FB 85 48 18 14
14E8:A5 47 6D 03 13 85 47 A5 76
14F0:48 6D 04 13 85 48 38 A5 AD
14F8:47 E9 03 85 47 A5 48 E9 43
1500:00 85 48 60 AD 0A 13 85 DB
1508:FA AD 0B 13 85 FB 20 AC B6
1510:14 A5 47 8D 05 13 A5 48 77
1518:8D 06 13 AD 09 13 8D 07 7E
1520:13 A5 FE 8D 0E 13 A5 FF FD
1528:8D 0F 13 AD 0C 13 85 FA CC
1530:AD 0D 13 85 FB 20 AC 14 FC
1538:AD 05 13 85 FA AD 06 13 E2
1540:85 FB A9 FA 8D B9 02 AD 16
1548:09 13 A2 01 A0 00 20 77 DC
1550:FF A5 FE A2 01 C8 20 77 D0
1558:FF A5 FF A2 01 C8 20 77 F8
1560:FF A9 47 8D B9 02 AD 07 EE
1568:13 A2 01 A0 00 20 77 FF 5E
1570:AD 0E 13 A2 01 C8 20 77 64
1578:FF AD 0F 13 A2 01 C8 20 EB
1580:77 FF 60 20 97 15 20 97 5D
1588:15 38 A5 FA E9 02 85 FA 0D
1590:A5 FB E9 00 85 FB 60 18 BE
1598:A5 FA 6D 10 13 85 FA A5 4D
15A0:FB 6D 11 13 85 FB 60 AD 02
15A8:1A 13 85 FA AD 1B 13 85 8A
15B0:FB 20 83 15 EA EA EA 60 DB
15B8:AD 1C 13 85 FA AD 1D 13 57
15C0:4C AF 15 20 A7 15 A9 FA 81
15C8:A2 01 A0 00 20 74 FF 8D F8
15D0:20 13 20 EF 15 8D 21 13 07
15D8:60 20 B8 15 A9 FA A2 01 23
15E0:A0 00 20 74 FF 8D 1E 13 2C
15E8:20 EF 15 8D 1F 13 60 A9 4A
15F0:FA A2 01 C8 20 74 FF 60 21
15F8:20 A7 15 A9 FA 8D B9 02 DD
1600:AD 0C 13 A2 01 A0 00 20 3D
1608:77 FF AD 0D 13 A2 01 C8 64
1610:20 77 FF 60 20 B8 15 A9 E7
1618:FA 8D B9 02 AD 1E 13 A2 2B
1620:01 A0 00 20 77 FF AD 1F 2D
1628:13 A2 01 C8 20 77 FF 60 72
1630:AD 16 13 CD 17 13 D0 06 A4
1638:A9 00 8D 22 13 60 8A 48 84
1640:A5 47 48 A9 80 85 47 A2 FF
1648:08 A9 00 8D 07 13 8D 08 63
1650:13 A5 47 2D 16 13 F0 03 0D
1658:EE 07 13 A5 47 2D 17 13 AA
1660:F0 03 EE 08 13 AD 07 13 94
1668:38 ED 08 13 F0 07 10 0E 30
1670:A9 02 4C 80 16 46 47 CA A6
1678:D0 CF 8A 4C 80 16 A9 01 C7
1680:8D 22 13 68 85 47 68 AA A9
1688:60 AD 13 13 8D 16 13 AD 7C
1690:15 13 8D 17 13 20 30 16 BE
1698:AD 22 13 D0 0F AD 12 13 F9
16A0:8D 16 13 AD 14 13 8D 17 75
16A8:13 20 30 16 60 20 AC 14 BE
16B0:A5 FE 85 FC A5 FF 85 FD 26
16B8:AD 09 13 8D 05 13 F0 3F CE
16C0:20 5C 17 AD 09 13 F0 3D 85
16C8:A0 00 A9 FC A2 01 20 74 18
16D0:FF 8D 16 13 A9 FE A2 01 E3
16D8:20 74 FF 8D 17 13 20 30 80
16E0:16 AD 22 13 F0 01 60 CE 14
16E8:05 13 F0 08 CE 09 13 F0 AC
16F0:14 C8 D0 D6 CE 09 13 D0 72
16F8:06 A9 00 8D 22 13 60 A9 33
1700:02 8D 22 13 60 A9 01 8D 41
1708:22 13 60 18 A5 33 69 01 67
1710:8D 1A 13 A5 34 69 00 8D 1D
1718:1B 13 38 A5 35 ED 1A 13 A2
1720:85 FA A5 36 ED 1B 13 4A 34
1728:85 FB 66 FA 18 AD 1A 13 53
1730:65 FA 8D 1C 13 AD 1B 13 DB
1738:65 FB 8D 1D 13 38 AD 1C 8C
1740:13 E9 26 8D 1C 13 AD 1D B5
1748:13 E9 00 8D 1D 13 38 A5 9E
1750:35 E9 51 85 49 A5 36 E9 4D
1758:00 85 4A 60 A9 49 A2 01 EF
1760:A0 00 20 74 FF 8D 09 13 85
1768:18 A5 49 69 01 85 FE A5 8D
1770:4A 69 00 85 FF 60 20 AC E4
1778:14 A9 49 8D B9 02 AD 09 57
1780:13 A2 01 A0 00 20 77 FF 7A
1788:AD 09 13 D0 01 60 A0 00 0A
1790:A9 FE A2 01 20 74 FF A2 2D
1798:49 8E B9 02 A2 01 C8 20 31
17A0:77 FF CE 09 13 D0 E9 60 05
17A8:38 A5 35 E5 33 8D 12 13 68
```

```
17B0:A5 36 E5 34 8D 13 13 A9 C7
17B8:FF 8D 14 13 A9 00 8D 15 7B
17C0:13 20 89 16 A9 00 85 FA 66
17C8:AD 22 13 C9 01 F0 02 E6 0C
17D0:FA 60 00 00 00 00 00 00 94
```

Program 2: Quicksort Demo

```
HD 10 BLOAD"SORT128.OBJ",P4864
KM 20 PRINT"{CLR}{DOWN}{WHT}HO
      W MANY RANDOM STRINGS TO
       CREATE":INPUT N
BQ 30 DIM A$(N):PRINT"{CLR}
      {DOWN}CREATING"N"RANDOM
      {SPACE}STRINGS":SD=-TI:A
      =RND(SD)
FC 40 FORI=1TON:PRINTI;CHR$(14
      5):N1=INT(RND(1)*10+1):A
      $="":FORJ=1TON1
EG 50 B$=CHR$(INT(RND(1)*26+65
      )):A$=A$+B$:NEXT:A$(I)=A
      $:NEXT
RA 60 PRINT"{2 DOWN}PRESS ANY
      {SPACE}KEY TO START SORT
      ":GETKEY A$
FX 70 FAST:T1=TI:SYS4864,,,,,N
      ,A$(1):T2=TI:PRINT"{CLR}
      {DOWN}DONE{2 DOWN}":SLOW
JK 80 IFPEEK(250)<>0THENPRINT"
      NOT ENOUGH MEMORY TO SOR
      T":END
BP 90 MT$=STR$((T2-T1)/60):PRI
      NT N"ELEMENTS SORTED IN"
      LEFT$(MT$,6)" SECONDS"
DF 100 PRINT"{2 DOWN}PRESS ANY
       KEY FOR SORTED LIST
       {DOWN}":GETKEY A$:FORI=
       1TON:PRINTA$(I):NEXT
```

Bar Charter

Article on page 82.

```
PA 100 N=38:DIMB(N):FORI=1TON:
       READT:B=B+T:B(I)=B:NEXT
       :REM SET N TO # OF INCR
       EMENTS
AD 110 INPUT"{CLR}ACCOUNT NAME
       ";AN$:AN$=LEFT$(AN$,39)
       :PRINT
XQ 120 DATA50,20,-15,25,30,12,
       -20,17
XS 130 DATA5,10,13,-9,22,11,10
       ,-17
XQ 140 DATA10,15,12,-30,-25,-1
       0,30,10
FR 150 DATA-10,-25,-16,-27,10,
       15,-16,10
QH 160 DATA-15,-16,-12,-20,-10
       ,12
GP 1000 REM{2 SPACES}BEGIN CHA
        RT ROUTINE
HX 1010 POKE53280,0:POKE53281,
        0:PRINT"{43}"
FR 1020 L5$="5{38 T}"
KB 1030 L0$="0{38 T}"
XB 1040 INPUT"SET INCREMENT VA
        LUE";INC:PRINT"{CLR}"
SS 1050 INC$=STR$(INC):IFLEN(I
        NC$)>5THEN1340
CD 1060 IFINC<1THEN1340
PX 1070 PRINT"RELATIVE BALANCE
        S. INCREMENTS = $"IN
HE 1080 FORI=1TO39:PRINT"{RVS}
         ";:NEXT:PRINT:PRINT"
        {UP}{OFF}"
XX 1090 FORI=1TO4:PRINT"{T}":N
        EXT
MH 1100 PRINTL5$:FORI=1TO4:PRI
        NT"{T}":NEXT
AF 1110 PRINTL0$:FORI=1TO4:PRI
        NT"{T}":NEXT
EB 1120 PRINTL5$:FORI=1TO4:PRI
        NT"{T}":NEXT
BA 1130 VL=22:X=1:A=0
HX 1140 A=A+1:IFA>NTHEN1290
XJ 1150 COL=COL+1:IFCOL>15THEN
        COL=1
PP 1160 POKE646,COL
HA 1170 BL=B(A)/INC
CB 1180 IFINC>B(A)THENEM=1:GOT
        O1260
MX 1190 IFBL=>20THENEM=2:GOTO1
        260
HG 1200 DV=VL-INT(BL)
EF 1210 POKE782,X:POKE781,DV:S
        YS65520
SH 1220 PRINT"{K}"
RK 1230 IFBL<2THEN1250
AP 1240 FORI=1TOBL-1:PRINTTAB(
        X)"{K}":NEXT
SX 1250 X=X+1:GOTO1140
RJ 1260 POKE782,X:POKE781,21:S
        YS65520
MX 1270 IFEM=1THENPRINT"<":GOT
        O1250
SK 1280 PRINT">":GOTO1250
EP 1290 POKE782,0:POKE781,22:S
        YS65520
BG 1300 PRINT"{4}{RVS}
        {2 SPACES}<-BELOW SCAL
        E{3 SPACES}:{3 SPACES}
        >-EXCEEDS RANGE
        {2 SPACES}{OFF}"
QE 1310 PRINT"ANY KEY TO EXIT.
        .."
XP 1320 GETOP$:IFOP$=""THEN132
        0
BR 1330 END:REM [END CHART ROU
        TINE - BRANCH BACK TO
        {SPACE}MAIN PROGRAM]
EF 1340 PRINT"{DOWN}UNACCEPTAB
        LE VALUE - OUT OF RANG
        E{DOWN}":GOTO1040
```

Fast Hi-Res Screen Dump

Article on page 70.

```
GP 10 INPUT"{CLR}{2 DOWN}{WHT}
      WHAT IS THE STARTING ADD
      RESS";L:LL=L
CD 20 READ A:IFA<0 THEN40
EQ 30 CKSUM=CKSUM+A:POKE LL,A:
      LL=LL+1:GOTO20
ME 40 IF CKSUM<> 33095 THEN PR
      INT "{CLR}{2 DOWN}ERROR
      {SPACE}IN DATA STATEMENT
      S":END
QJ 50 PRINT"{CLR}{2 DOWN}HIRES
       DUMP INSTALLED":PRINT"
      {2 DOWN}SYS"L"TO ACTIVAT
      E"
PM 60 DATA 169,0,32,189,255,16
      9,4,170
FQ 70 DATA 160,4,32,186,255,32
      ,192,255,162
GC 80 DATA 4,32,201,255,169,27
      ,32,210
JJ 90 DATA 255,169,64,32,210,2
      55,169,27
SJ 100 DATA 32,210,255,169,65,
       32,210,255
GS 110 DATA 169,8,32,210,255,1
       62,39,134
AC 120 DATA 250,169,27,32,210,
       255,169,75
XJ 130 DATA 32,210,255,169,200
       ,32,210,255
DS 140 DATA 169,0,32,210,255,1
       62,0,134
ED 150 DATA 251,162,0,134,252,
       166,251,134
EK 160 DATA 195,162,0,134,196,
       162,6,24
SS 170 DATA 6,195,38,196,202,2
       08,249,162
BB 180 DATA 0,134,253,134,254,
       162,5,24
AB 190 DATA 165,253,101,195,13
       3,253,165,254
SH 200 DATA 101,196,133,254,20
       2,208,240,134
SX 210 DATA 196,166,250,134,19
       5,162,3,24
SC 220 DATA 6,195,38,196,202,2
       08,249,240
CD 230 DATA 4,16,164,208,186,2
       4,165,195
EH 240 DATA 101,252,133,195,16
       5,196,105,32
KF 250 DATA 133,196,24,165,253
       ,101,195,133
HP 260 DATA 253,165,254,101,19
       6,133,254,160
BH 270 DATA 0,132,195,177,253,
       240,10,162
BX 280 DATA 8,74,38,195,202,20
       8,250,165
KD 290 DATA 195,32,210,255,166
       ,252,232,224
XR 300 DATA 8,208,136,166,251,
       232,224,25
AM 310 DATA 208,193,169,13,32,
       210,255,166
CX 320 DATA 250,202,16,181,32,
       204,255
AH 330 DATA 169,4,76,195,255,-
       1
```

Video Setup 64

Article on page 66.

```
DC 10 PRINT "64 SCREEN SETUP"
RG 20 DIM S(255)
JR 30 S0=16384
CA 40 PRINT "WANT TO USE:"
EF 50 PRINT "1. CHARACTERS
KA 60 PRINT "2. HIGH RES
CR 70 INPUT "1 OR 2";J8
RH 80 IF J8<1 OR J8>2 GOTO40
SB 90 B3=4:IF J8=2 GOTO160
DM 100 PRINT "DO YOU WANT TO B
       UILD
CX 110 PRINT "{3 SPACES}YOUR O
       WN CHARACTER SET (Y/N)"
       ;
QQ 120 INPUT Y$:Y$=LEFT$(Y$,1)
EX 130 IF Y$="Y" GOTO160
FM 140 IF Y$<>"N" GOTO90
EQ 150 B3=0:C=64
EB 160 PRINT
PA 170 PRINT "PICK A MEMORY AR
       EA:"
GD 180 FOR J=0 TO 3
EA 190 IF J8=2 OR B3>0 OR J=0
       {SPACE}OR J=2 THEN PRIN
       T J;": ";J*S0;"TO";(J+1
       )*S0-1
QC 200 NEXT J
AS 210 PRINT "YOUR CHOICE (0 T
       O 3)";:IF J8=2 THEN PRI
       NT "(1 OR 3 BEST)";
GB 220 INPUT B:IF B<0 OR B>3 G
       OTO160
XM 230 IF B=0 THEN FOR J=0 TO
       {SPACE}3:S(J)=2:NEXT J
PR 240 IF B=0 OR B=2 THEN FOR
       {SPACE}J=64 TO 127:S(J)
       =2:NEXT J
DK 250 REM
AB 260 IF J8=1 THEN PRINT "--C
       HARACTER SCREEN--":S=32
```

```
BG 270 IF J8=2 THEN PRINT "--H
       I RES SCREEN--":S=128
SG 280 ON J8 GOSUB760,800
KM 290 INPUT "ARE YOU READY FO
       R DATA";Y$
ED 300 IF LEFT$(Y$,1)<>"Y" GOT
       O290
PQ 310 PRINT "{CLR}{2 DOWN}"
BJ 320 PRINT "{5 SPACES}VIDEO
       {SPACE}LOCATIONS ";
SQ 330 PRINT
HK 340 IF B5=32 THEN PRINT "HI
       GH RESOLUTION."
GS 350 IF J8=1 THEN PRINT "TEX
       T SCREEN"
EG 360 PRINT "VIDEO MATRIX:";B
       *S0+V*64;"TO";B*S0+(V+1
       6)*64-1
PA 370 PRINT "(SPRITE POINTERS
        AT";B*S0+V*64+1016;"TO
       ";B*S0+V*64+1023;")"
AR 380 IF J8=1 AND B3=0 THEN P
       RINT "STANDARD CHARACTE
       R SET.":C=64:GOTO400
SA 390 PRINT "CHARACTER BASE:"
       ;B*S0+C*64;"TO";B*S0+(C
       +S)*64-1
MA 400 PRINT
JR 410 PRINT "POKE 56576,";MID
       $(STR$(7-B),2)
CX 420 PRINT "{4 SPACES}(TO SE
       T MEMORY BLOCK)"
KP 430 PRINT "POKE 53272,";MID
       $(STR$(V+C/16),2)
PD 440 PRINT "{4 SPACES}(TO SE
       T VM AND CB)"
MM 450 IF J8=1 THEN GOSUB1070
CG 460 PRINT "POKE 53265,";MID
       $(STR$(B5+27),2)
SH 470 IF B5<>0 THEN PRINT "
       {4 SPACES}(TO ENABLE HI
        RES)"
GE 480 IF B5=0 THEN PRINT "
       {4 SPACES}(TO KILL HI R
       ES)"
BB 490 INPUT "WILL YOU WANT SP
       RITES";Y$
KH 500 IF Y$="N" GOTO590
FG 510 IF Y$<>"Y" GOTO490
SR 520 PRINT "SPRITES MAY BE P
       LACED AT:"
QS 530 F=-1
SA 540 FOR J=0 TO 255
JJ 550 IF S(J)=0 AND F=-1 THEN
        GOSUB700
PK 560 IF S(J)<>0 AND F<>-1 TH
       EN GOSUB730
GM 570 NEXT J
KQ 580 IF F<>-1 THEN GOSUB730
QR 590 PRINT:IF B=3 GOTO630
XP 600 PRINT "CAREFUL:"
PM 610 PRINT "BASIC IS USUALLY
        IN 2049 TO 40959"
XQ 620 END
HK 630 S$="SPRITES"
GK 640 FOR J=64 TO 127 STEP 16
EG 650 IF S(J)>0 THEN S$="** W
       ARNING! **"+CHR$(13)+"A
       DDRESSES"
SA 660 NEXT J
EB 670 PRINT S$;" FROM 53248 T
       O 57343 ARE"
XR 680 PRINT "TOUGH TO GET AT"
EB 690 END
JB 700 P=J
XF 710 F=0
FC 720 RETURN
RB 730 PRINT S0*B+P*64;"TO";S0
       *B+J*64-1;"(SPRITES";P;
       "TO";J-1;")"
KQ 740 F=-1
KE 750 RETURN
CK 760 REM
XK 770 IF B3>0 THEN PRINT "THE
        CHARACTER SET MAY BE A
       T:":GOSUB840
KD 780 PRINT "VIDEO MATRIX (SC
       REEN MEMORY)...":GOSUB9
       60
KK 790 RETURN
EX 800 B5=B5+32
CX 810 PRINT "THE HI-RES SCREE
       N MAY BE AT:":GOSUB840
DB 820 PRINT "VIDEO MATRIX (CO
       LOR MEMORY)...":GOSUB96
       0
GP 830 RETURN
FQ 840 N=0:FOR J=0 TO 255 STEP
        S
BX 850 IF S(J)>T OR S(J+S-1)>T
        GOTO870
MG 860 PRINT "(";J/S;")";B*S0+
       J*64;"TO";B*S0+(J+S)*64
       -1:N=N+1:C=J/S
ER 870 NEXT J
KM 880 IF N<2 GOTO920
XR 890 PRINT "YOUR CHOICE (0 T
       O";(J-S)/S;")";
MC 900 INPUT C0:IF C0<0 OR C0>
       C GOTO840
BR 910 C=C0
SF 920 C=C*S
EA 930 FOR J=C TO C+S-1:S(J)=3
       :NEXT J
BC 940 PRINT
CD 950 RETURN
CR 960 FOR J=0 TO 255 STEP 16
HF 970 IF S(J)>T OR S(J+15)>T
       {SPACE}GOTO990
GG 980 PRINT "(";J/16;")";B*S0
       +J*64;"TO";B*S0+(J+16)*
       64-1:V=J/16
JF 990 NEXT J
MA 1000 PRINT "YOUR CHOICE (0
        {SPACE}TO";V;")";
MK 1010 INPUT C0:IF C0<0 OR C0
        >V GOTO1000
JF 1020 V=C0
PK 1030 V=V*16
DH 1040 FOR J=V TO V+15:S(J)=3
        :NEXT J
KX 1050 PRINT
FC 1060 RETURN
BB 1070 PRINT "POKE 648,";MID$
        (STR$(B*64+V/4),2)
GD 1080 PRINT "{4 SPACES}(TO C
        ONNECT 'PRINT')"
QE 1090 RETURN
```

Power BASIC:
Program Mis-Matcher

Article on page 108.

Program 1: 64/128 Program Mis-Matcher

```
KJ 10 SA=49152:CS=10600:FR=251
      :PRINT"{CLR}{WHT}"
SM 20 FORT=SATOSA+65:READA:X=X
      +A:POKET,A:NEXT
JH 30 IFX<>CSTHENPRINT"ERROR I
      N DATA STATEMENTS.":STOP
GG 40 PRINTCHR$(14)
CA 50 INPUT"NAME OF FIRST PROG
      RAM ";F1$:INPUT"NAME OF
      {SPACE}SECOND PROGRAM";F
      2$
RB 60 PRINT"{CLR}OUTPUT TO PRI
      NTER?{2 SPACES}Y/N"
EQ 70 GET SP$:IFSP$=""THEN70
GX 80 IFSP$="Y"THEN OPEN 4,4,7
      :PRINT#4,"COMPARING "F1$
      " TO "F2$".":PRINT#4
RH 90 J$="{20 SPACES}{20 LEFT}
      "
AK 100 OPEN 2,8,2,F1$:OPEN 3,8
       ,3,F2$:GOSUB650
EG 110 FORT=1TO2:GET#2,A$:GET#
       3,B$:NEXT:REM{2 SPACES}
       THROW AWAY FIRST 2 BYTE
       S
KB 120 FORT=1TO2:GET#2,A$:GET#
       3,B$:NEXT:REM{2 SPACES}
       THROW AWAY LINE LINKS
JE 130 A=0:IFA$<>""THENA=ASC(A
       $)
AA 140 B=0:IFB$<>""THENB=ASC(B
       $)
EQ 150 IF A=0 AND B=0 THEN300
BX 160 IFA=0THENLA=64000:GOTO1
       80
PG 170 GOSUB480:REM GET LINE N
       UMBER
DG 180 IFB=0THENLB=64000:GOTO2
       00
AH 190 GOSUB520:REM GET LINE N
       UMBER
JB 200 IFLA<>LB THEN GOSUB320:
       REM{2 SPACES}CHECK FOR
       {SPACE}DIFFERENT LINE #
XF 210 IFLA=64000ANDLB=64000TH
       EN300
BA 220 PRINT"CHECKING LINE"LA:
       PRINT"{UP}";
RF 230 SYS SA
SF 240 IF PEEK(FR+1)=0 THEN120
XP 250 PRINT J$ "LINES"LA"DO N
       OT AGREE."
DC 260 IF SP$<>"Y" THEN120
AG 270 IF TG=1 THEN PRINT#4
GP 280 TG=0:PRINT#4,"LINES"LA"
       DO NOT AGREE."
GE 290 GOTO120
RA 300 CLOSE2:CLOSE3:CLOSE4:EN
       D
EQ 310 REM --{37 SPACES}EXTRA
       {SPACE}LINE
JJ 320 IF LA>=LB THEN390
BX 330 PRINT J$"LINE"LA"IN
       {RVS} "F1$" {OFF} NOT I
       N {RVS} "F2$"."
SC 340 IF SP$="Y" AND TG=0 THE
       N PRINT#4
BK 350 TG=1:IF SP$="Y" THEN PR
       INT#4,"LINE"LA"IN "F1$"
        NOT IN "F2$"."
QA 360 POKE FR,2:SYS SA+55
CF 370 GET#2,A1$:GET#2,A2$:IF
       {SPACE}A1$="" AND A2$="
       " THEN LA=64000:GOTO320
PQ 380 GOSUB480:GOTO320:REM GE
       T NEW LINE #
RX 390 IF LB>=LA THEN460
XP 400 PRINT J$"LINE"LB"IN
       {RVS} "F2$" {OFF} NOT I
       N {RVS} "F1$"."
XS 410 IF SP$="Y" AND TG=0 THE
       N PRINT#4
GD 420 TG=1:IF SP$="Y" THEN PR
       INT#4,"LINE"LB"IN "F2$"
        NOT IN "F1$"."
AP 430 POKE FR,3:SYS SA+55
RH 440 GET#3,B1$:GET#3,B2$:IFB
       1$=""ANDB2$=""THENLB=64
       000:GOTO320
FX 450 GOSUB520:GOTO320
KD 460 RETURN
MR 470 REM -- GET LINE NUMBERS
AF 480 GET#2,A1$:GET#2,A2$
BQ 490 A1=0:IFA1$<>""THENA1=AS
       C(A1$)
AJ 500 A2=0:IFA2$<>""THENA2=AS
       C(A2$)
BD 510 LA=A2*256+A1:RETURN
```

```
PJ 520 GET#3,B1$:GET#3,B2$
BG 530 B1=0:IFB1$<>""THENB1=AS
       C(B1$)
DB 540 B2=0:IFB2$<>""THENB2=AS
       C(B2$)
XX 550 LB=B2*256+B1:RETURN
QR 560 DATA 169,0,133,252,162,
       2,32,198
GM 570 DATA 255,160,255,200,32
       ,207,255,240
XP 580 DATA 6,153,66,192,76,11
       ,192,132
SQ 590 DATA 251,162,3,32,198,2
       55,160,255
PB 600 DATA 200,32,207,255,240
       ,10,217,66
QP 610 DATA 192,240,245,230,25
       2,76,32,192
DS 620 DATA 196,251,240,2,230,
       252,96,166
JF 630 DATA 251,32,198,255,32,
       207,255,208
BH 640 DATA 251,96
QQ 650 OPEN15,8,15:INPUT#15,A,
       B$,C,D:IFATHENPRINTA,B$
       ,C,D:STOP
AB 660 RETURN
```

Program 2: Modifications For Plus/4 And 16

```
CC 5 POKE 56,62:CLR
JA 10 SA=15872:CS=9528:FR=159:
      PRINT"{CLR}{BLK}"
FX 560 DATA 169,0,133,160,162,
       2,32,198
GM 570 DATA 255,160,255,200,32
       ,207,255,240
KM 580 DATA 6,153,66,62,76,11,
       62,132
GJ 590 DATA 159,162,3,32,198,2
       55,160,255
PB 600 DATA 200,32,207,255,240
       ,10,217,66
PM 610 DATA 62,240,245,230,160
       ,76,32,62
EP 620 DATA 196,159,240,2,230,
       160,96,166
DM 630 DATA 159,32,198,255,32,
       207,255,208
BH 640 DATA 251,96
```

Mastering 128 Sound And Music

Article on page 88.

Program 1: Custom Envelope

```
HA 10 TEMPO 8:VOL 8:PLAY"X0U9"
RS 20 INPUT"{CLR}{DOWN}DEFAULT
       ENVELOPE TO COMPARE (0-
      9)";E:IF E<0 OR E>9 THEN
      20
EX 30 PRINT"{2 DOWN}{RVS}FOR C
      USTOM ENVELOPE{OFF}
      {DOWN}":INPUT"ATTACK RAT
      E (0-15)";A:IF A<0 OR A>
      15 THEN30
EH 40 INPUT "DECAY RATE (0-15)
      ";D:IF D<0 OR D>15 THEN4
      0
RD 50 INPUT"SUSTAIN LEVEL (0-1
      5)";S:IF S<0 OR S>15 THE
      N50
CE 60 INPUT"RELEASE RATE (0-15
      )";R:IF R<0 OR R>15 THEN
      60
JG 70 INPUT"WAVEFORM (0-4)";W:
      IF W<0 OR W>15 THEN70
FK 80 IF W<>2 THEN100
KH 90 INPUT"PULSE WIDTH (0-409
      5)";P:IF P<0 OR P>4095 T
      HEN90
KQ 100 PRINT"{DOWN}PRESS P TO
       {SPACE}PLAY AND COMPARE
       YOUR CUSTOM":PRINT USI
      NG"ENVELOPE TO DEFAULT
      {SPACE}ENVELOPE #";E
SP 110 PRINT"{DOWN}PRESS C TO
       {SPACE}CHANGE YOUR CUST
      OM ENVELOPE":PRINT"
      {DOWN}PRESS D TO CHANGE
       THE DEFAULT ENVELOPE":
      PRINT"FOR COMPARISON"
CJ 120 GET X$:IF X$="P" THEN18
       0
HH 130 IF X$="C" THEN PRINT"
       {CLR}":GOTO30
KF 140 IF X$="D" THEN160
SP 150 GOTO120
PK 160 INPUT"{CLR}{DOWN}DEFAUL
       T ENVELOPE TO COMPARE (
       0-9)";E:IF E<0 OR E>9 T
      HEN160
EP 170 GOTO100
HB 180 A$="V104QCIDIEIFIGIAIBO
       5WCQR":B$="V205QCO4IBIA
      IGIFIEIDWCQR":PLAY"V1T1
      V2T2"
SC 190 PRINT USING"{DOWN}{OFF}
       {6 SPACES}THIS IS DEFAU
      LT ENVELOPE #";E:T$=STR
      $(E):ENVELOPE 0,0,9,0,0
      ,2,1536
JP 200 PLAY"V1T":PLAY T$:PLAY
       {SPACE}A$:PRINT"{UP}
       {6 SPACES}{RVS}THIS IS
       {SPACE}YOUR CUSTOM ENVE
      LOPE":ENVELOPE 0,A,D,S,
      R,W,P
QM 210 PLAY"V2T0":PLAY B$:PRIN
      T"{UP}{34 SPACES}":GOTO
      120
```

Program 2: VF16

```
MB 10 PRINT"{CLR}{5 DOWN}{TAB}
      {2 SPACES}VISION FUGITIV
      E XVI":PRINT"{5 DOWN}
      {2 TAB}{3 SPACES}BY":PRI
      NT"{5 DOWN}{TAB}
      {3 SPACES}SERGEI PROKOFI
      EV"
JS 20 TEMPO 6:ENVELOPE 0,0,9,2
      ,1,2,1536:PLAY"X0U9":PLA
      Y"V1T0V2T0V3T0"
CC 30 A$="V105HEV3QRO4HEV105Q#
      DV2HFV1QDV304HE"
BS 40 B$="V105Q#CV2HEV1QCV304H
      EV104QBV205H#DV105ICV304
      HEV1IB"
BS 50 C$="V104Q#FV205HDV104Q#G
      V3HEV1QAV205H#CV104I#AV3
      HEV1IB"
EF 60 D$="V105QCV2HCV1I#CV304H
      EV105ID.Q#DV204HBV3HEV10
      5SES#G":VOL 9:PLAY A$:PL
      AY B$:VOL 7:PLAY C$:VOL
      {SPACE}9:PLAY D$
QK 70 E$="V105HEV204H#AV3HEV20
      5HFV1Q#DQDV304HE":F$="V1
      05Q#CV2HEV1QCV304HEV1QBV
      205H#DV1ICV304HEV1IB"
QQ 80 G$="V104Q#FV205HDV104Q#G
      V3HEV1QAV205H#CV104I#AV3
      HEV1IB"
FQ 90 H$="V105HCV2HCV304HEV2HB
      V105HEV304QE"
KX 100 VOL 11:PLAY E$:PLAY F$:
       VOL 9:PLAY G$:VOL 7:TEM
      PO 5:PLAY H$:TEMPO 6
HS 110 I$="V303SEV204IGV1IBIRV
       303SBSRO4SFV2QDV1QAV3SR
       O3SBSRO2SAV104IEIRV303S
       FSRSBV104QDV3SRO3SFSR"
CS 120 J$=I$:K$="V303SEV104IEI
       RV303SBSRO4SFV1QDV3SRO3
       SBSRO2SAV204IGV1IBIRV3O
       3SFSRSBV204QDV1QAV3SRO3
       SFSR"
QC 130 L$="V303SEV104IEIRV303S
       BSRO4SFV1QDV3SRO3SBSRO2
       SAV104HEV3SRO3SFSRSBSR.
       IFV2IR"
CB 140 VOL 5:PLAY I$:PLAY J$:P
       LAY K$:PLAY L$
AX 150 M$="V2IRV104ICIRV303SAS
       RO4SFV1QDV3SRO3SASRSCV2
       O4IAV105ICIRV303SGSRO4S
       CV2QEV1QBV3SRO3SGSR"
EA 160 N$="V303SFV104IDIRV303S
       ASRO4SGV1QEV3SRO3SASRSC
       V204IBV105IDIRV303SASRO
       4SEV2QFV105QCV3SRO3SASR
       "
QQ 170 O$="V303HBV104IGIRV2SES
       RSDV1QFV2SRICIRV1IBV303
       QAV204SCSRSDV3QFV1QAV2S
       RIE"
MM 180 P$="V2IRV104IGV303HBV2O
       4SESRSDV1QFV2SRICIRV1IB
       V303QAV204SCSRSDV3QFV1Q
       AV2SRIE"
CB 190 PLAY M$:VOL 7:PLAY N$:P
       LAY O$:PLAY P$:Q$="V2IR
       V104HGV303WBV204SCSRSDS
       RIEIRV1HFV2SDSRSCSRID"
GM 200 R$="V204HDV1HGV303SBSRS
       ASRSGSRSFSRHEV204HEHR"
SR 210 S$=A$:T$=B$:PLAY Q$:VOL
        5:TEMPO 5:PLAY R$:TEMP
       O 6:VOL 9:PLAY S$:PLAY
       {SPACE}T$:U$=C$
BJ 220 V$="V105HCV2WCV304WEV10
       6.HC":W$="V2QRO3QAV3QDV
       104QAQGV303QCV2QGQFV302
       QBV104QF"
BH 230 X$="V105HEV304QEHEV105Q
       #DV2HFV1QDV304HE":PLAY
       {SPACE}U$:PLAY V$:VOL 7
       :PLAY W$:PLAY X$
QG 240 Y$=T$:Z$=U$:AA$=V$:AB$=
       W$:PLAY Y$:PLAY Z$:PLAY
        AA$:TEMPO 5:PLAY AB$:A
       C$=X$:AD$=Y$
RS 250 AE$="V104Q#FV205HDV104Q
       #GV3HEV1QAV205H#CV104I#
       AV3QEV1IB"
CE 260 AF$="V105HCV3QCO4QEQCV1
       06HEV303QE"
ES 270 VOL 5:PLAY AC$:PLAY AD$
       :PLAY AE$:PLAY AF$
JK 280 AG$="V303WEV106WE":AH$=
       "V106.WEV205.WEV303.WE"
       :PLAY AG$:VOL 3:PLAY AH
       $:END
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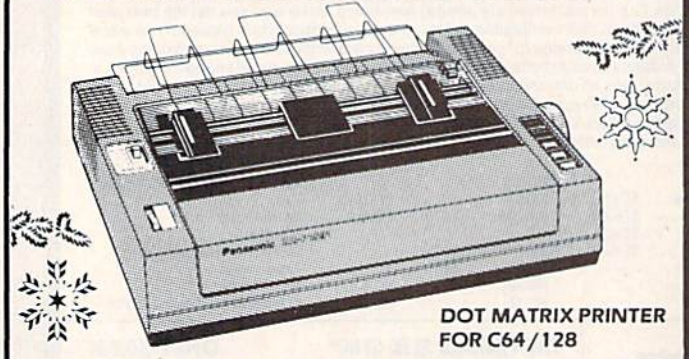

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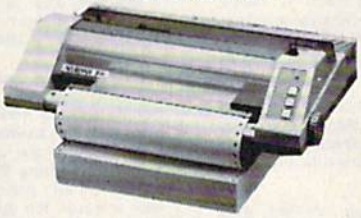

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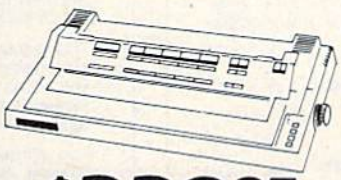

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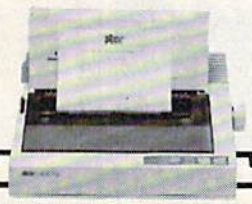

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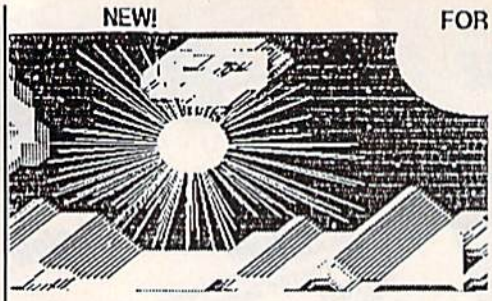

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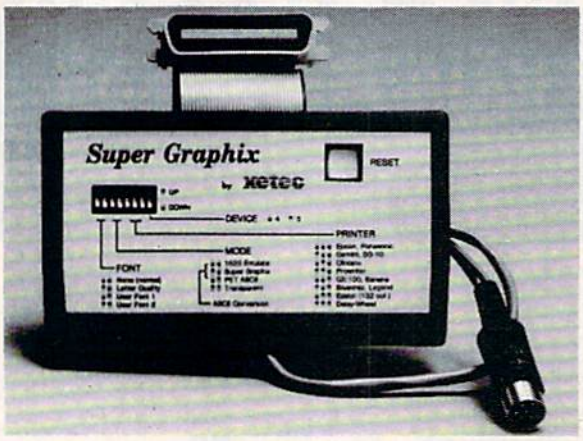

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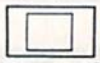
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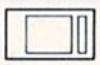
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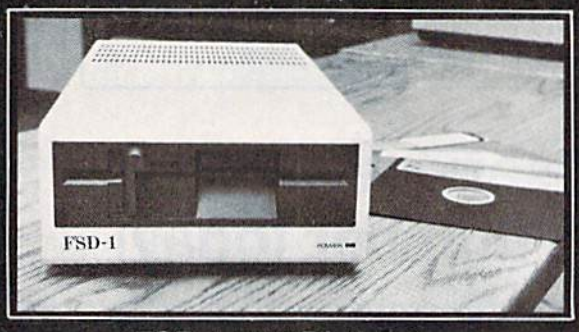

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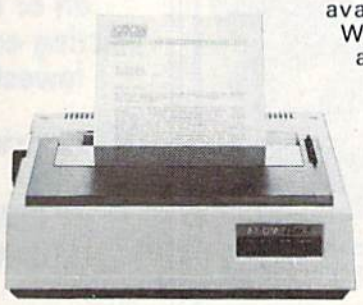

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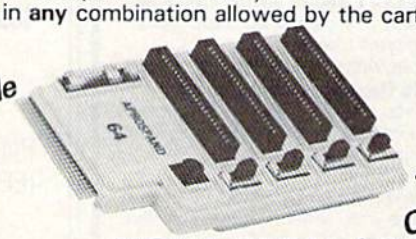

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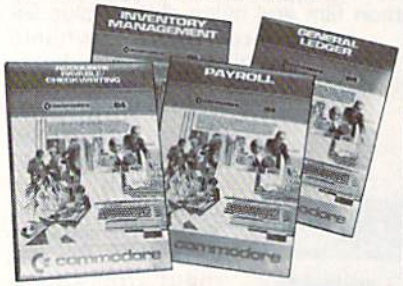

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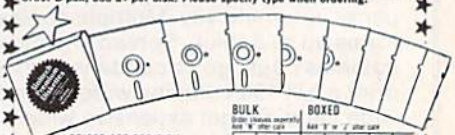

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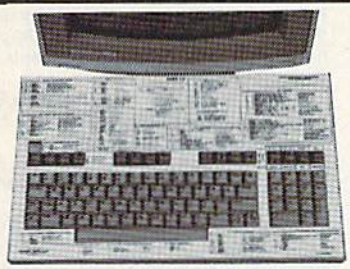

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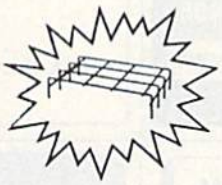

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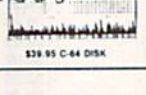

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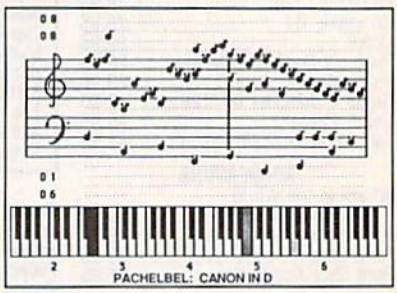

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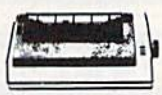

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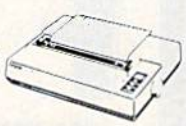

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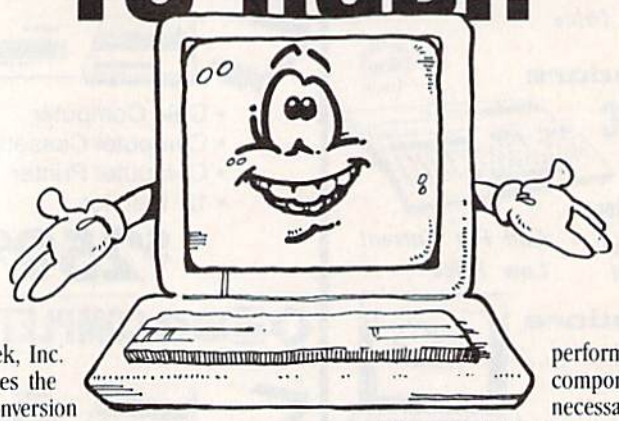

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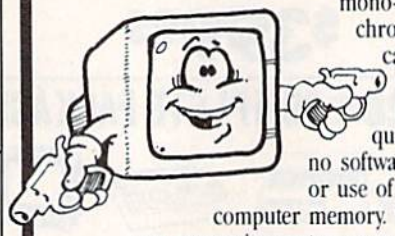

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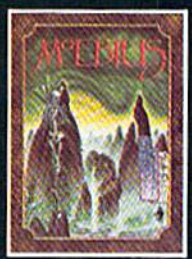

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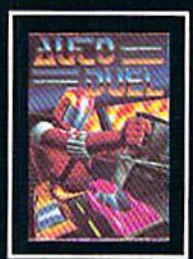

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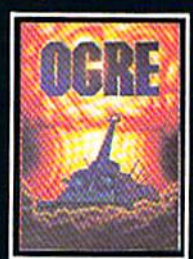

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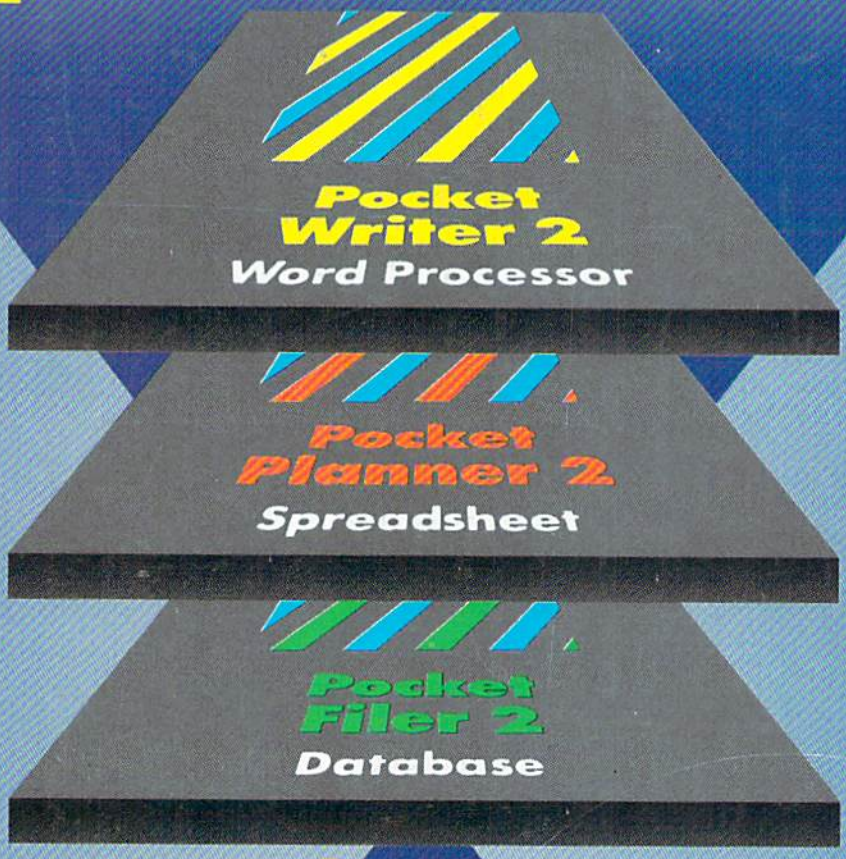

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